Northeast Fisheries Science Center Reference Document 12-21

Stock Assessment of Summer Flounder for 2012

by Mark Terceiro

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EXECUTIVE SUMMARY

This assessment of the summer flounder (*Paralichthys dentatus*) stock along the U.S. Atlantic coast (Maine to North Carolina) is an update through 2011 of commercial and recreational fishery catch data, research survey indices of abundance, and the analyses of those data. The summer flounder stock was not overfished and overfishing was not occurring in 2011 relative to the biological reference points established in the 2008 SAW 47 assessment. The fishing mortality rate (F) was estimated to be 0.241 in 2011, below the fishing mortality threshold reference point = Fishing mortality producing Maximum Sustainable Yield (FMSY) = F35% = 0.310. Spawning Stock Biomass (SSB) was estimated to be 57,020 metric tons (mt) = 125.708 million lbs in 2011, 5% below the biomass target reference point = Spawning Stock Biomass at Maximum Sustainable Yield (SSBMSY) = SSB35% = 60,074 mt = 132.440 million lbs. The NMFS determined in November 2011 that the summer flounder stock reached the biomass target (i.e., was rebuilt) in 2010, based on the 2011 assessment update.

Reported 2011 landings in the commercial fishery were 7,511 mt = 16.559 million lbs, about 94% of the commercial quota. Estimated 2011 landings in the recreational rod-and-reel fishery (as estimated by the MRIP) were 2,645 mt = 5.831 million lbs, about 50% of the recreational harvest limit. Total commercial and recreational landings in 2011 were 10,156 mt = 22.390 million lbs and total commercial and recreational discards were 1,222 mt = 2.694 million lbs, for a total catch in 2011 of 11,378 mt = 25.084 million lbs. Commercial landings have accounted for 56% of the total catch since 1982, with recreational landings accounting for 36%, recreational discards about 5%, and commercial discards about 3%. Commercial discard losses in the otter trawl and scallop dredge fisheries have accounted for about 5% of the total commercial catch, assuming a discard mortality rate of 80%. Recreational discard losses have accounted for about 12% of the total recreational catch, assuming a discard mortality rate of 10%.

Fishing mortality (F) calculated from the average of the currently fully recruited ages (3-7+) ranged between about 1.0 and 2.0 during 1982-1996. The fishing mortality rate declined to below 1.0 after 1996 and was estimated to be 0.241 in 2011, with a 50% probability that the fishing mortality rate in 2011 was between 0.228 and 0.254. SSB decreased from about 25,000 mt = 55.116 million lbs in the early 1980s to about 7,000 mt = 15.432 million lbs in 1989, and then increased to above 40,000 mt = 88.185 million lbs by 2002. SSB was estimated to be 57,020 mt = 125.708 million lbs in 2011, with a 50% probability that SSB in 2011 was between 54,440 and 59,822 mt (120.020 and 131.885 million lbs). The arithmetic average recruitment from 1982 to 2011 is 42 million fish at age 0. The 1982 and 1983 year classes are the largest in the assessment time series, at 72 and 81 million fish; the 1988 year class is the smallest at 13 million fish. The 2009 year class is estimated to be about 47 million fish, about 10% above average. The current estimate of the size of the 2009 year class is about 50% smaller than the initial estimate from the 2010 assessment of 80 million fish. Both the 2010 and 2011 year classes are estimated to be smaller than average.

The summer flounder stock assessment has historically exhibited a consistent retrospective pattern of underestimation of F and overestimation of SSB; the causes of this pattern have not been determined. For the last six terminal years, however, fishing mortality has been overestimated and SSB underestimated. A recent pattern of retrospective overestimation in recruitment (R) is also evident. The estimates of SSB, R and F from the last five assessments are consistent with the most recent internal retrospective pattern of the assessment model.

If the landings of summer flounder in 2012 equal the specified Total Allowable Landings (TAL) = 10,238 mt = 22.571 million lbs, the 2012 median (50% probability) discards are projected to be 1,455 mt = 3.208 million lbs, and the median total catch is projected to be 11,693 mt = 25.779 million lbs. The median F in 2012 is projected to be 0.247, below the fishing mortality threshold = FMSY = F35% = 0.310. The median SSB on November 1, 2012 is projected to be 55,300 mt = 121.916 million lbs, below the biomass target of SSBMSY = SSB35% = 60,074 mt = 132.440 million lbs.

If the stock is fished at the fishing mortality threshold = FMSY = F35% = 0.310 in 2013, median landings are projected to be 11,892 mt = 26.217 million lbs, with median discards of 1,637 mt = 3.609 million lbs, and median total catch = 13,523 mt = 29.813 million lbs. This projected median total catch is equivalent to the Overfishing Limit (OFL) for 2013, and is less than the MSY = 14,632 mt (32.258 million lbs) of total catch (13,122 mt = 28.929 million lbs of landings plus 1,510 mt = 3.329 million lbs of discards). The median SSB on November 1, 2013 is projected to be 52,843 mt = 116.499 million lbs, 88% of the biomass target of SSBMSY = SSB35% = 60,074 mt = 132.440 million lbs. The projected catch estimates in the following table are medians of the catch distributions for fixed F in 2013.

Total Catch (OFL), Landings, Discards, Fishing Mortality (F)
and Spawning Stock Biomass (SSB) in 2013
Catches and SSB in metric tons

Total Catch	Landings	Discards	F	SSB
13,523	11,892	1,637	0.310	52,843

STOCK UNIT

The definition provided by Wilk et al. (1980) of a unit stock extending from Cape Hatteras north to New England has been accepted in this and previous assessments. A consideration of summer flounder stock structure incorporating tagging data concluded that most evidence supported the existence of stocks north and south of Cape Hatteras, with the stock north of Cape Hatteras possibly composed of two distinct spawning aggregations, off New Jersey and Virginia-North Carolina (Kraus and Musick 2001). The conclusions of Kraus and Musick (2001) are consistent with the current assessment stock unit. The Mid-Atlantic Fishery Management Council (MAFMC) and Atlantic States Marine Fisheries Commission (ASMFC) joint Fishery Management Plan (FMP) defines the management unit for summer flounder as extending from the southern border of North Carolina north to the U.S.-Canadian border. A summer flounder genetics study revealed no population subdivision at Cape Hatteras (Jones and Quattro 1999), consistent with the definition of the management unit.

HISTORY OF MANAGEMENT AND ASSESSMENT

An overview of the history of the summer flounder FMP and assessment is provided in this section and the text box below. Management of the summer flounder fishery began through the implementation of the original Summer Flounder FMP in 1988, a time that coincided with the lowest levels of stock biomass for summer flounder since the late 1960s. The MAFMC and ASMFC cooperatively develop fishery regulations, with the National Marine Fisheries Service (NMFS) serving as the federal implementation and enforcement entity. Cooperative management was developed because significant catch is taken from both state (0-3 miles offshore) and federal waters (3-200 miles offshore).

Amendment 1 to the FMP in 1990 established the overfishing definition for summer flounder as equal to Fmax, initially estimated as 0.23 (NEFC 1990). Amendment 2 in 1992 established target fishing mortality rates for summer flounder for 1993-1995 as F = 0.53, and Fmax = 0.23 for 1996 and beyond. Regulations enacted under Amendment 2 to meet those fishing mortality rate targets included 1) an annual fishery landings quota with 60% allocated to the commercial fishery and 40% to the recreational fishery based on the historical (1980-1989) division of landings, with the commercial allocation further distributed among the states based on their share of commercial landings during 1980-1989, 2) a commercial minimum landed fish size limit at 13 in (33 cm), 3) a minimum mesh size of 5.5 in (140 mm) diamond or 6.0 in (152 mm) square for commercial vessels using otter trawls that possess 100 lbs (45 kg) or more of summer flounder, with exemptions for the flynet fishery and vessels fishing in an exempted area off southern New England during 1 November to 30 April, 4) permit requirements for the sale and purchase of summer flounder, and 5) annually adjustable regulations for the recreational fishery, including an annual harvest limit, closed seasons, a 14 in (36 cm) minimum landed fish size, and possession limits.

The results of stock assessments conducted in the mid-1990s indicated that summer flounder abundance was not increasing as rapidly as projected when Amendment 2 regulations were implemented. In anticipation of the need to drastically reduce fishery quotas in 1996 to meet the management target of Fmax, the MAFMC and ASMFC modified the fishing mortality rate reduction schedule in 1995 to allow for more stable landings between years while slowing the rate of stock rebuilding. Amendment 7 to the FMP set target fishing mortality rates of 0.41 for 1996 and 0.30 for 1997, with a target of Fmax = 0.23 for 1998 and beyond. Total landings

were to be capped at 8,400 mt (18.519 million lbs) in 1996-1997 unless a higher quota in those years provided a realized F = 0.23.

Amendment 12 in 1999 defined overfishing for summer flounder as occurring when the fishing mortality rate exceeded the threshold fishing mortality rate of Fishing mortality producing Maximum Sustainable Yield (FMSY). Because FMSY could not be reliably estimated for summer flounder, Fmax = 0.24 was used as a proxy for FMSY. FMSY was also defined as the target fishing mortality rate. Under Amendment 12, the stock was defined to be overfished when total stock biomass fell below the biomass threshold of one-half of the biomass target, BMSY. Because BMSY could not be reliably estimated, the biomass target was defined as the product of total biomass per recruit and contemporary (1982-1996) median recruitment, at that time estimated to be 153,350 mt (338 million lbs), with the biomass threshold defined as 76,650 mt (169 million lbs). In the 1999 stock assessment (Terceiro 1999) the reference points were updated using new estimates of median recruitment (1982-1998) and mean weights at age (1997-1998), which resulted in a biomass target of 106,444 mt (235 million lbs) and minimum biomass threshold of 53,222 mt (118 million lbs). The Terceiro (1999) reference points were retained in the 2000 and 2001 stock assessments (NEFSC 2000, MAFMC 2001a) because of the stability of the input data. Concurrent with the development of the 2001 assessment, the MAFMC and ASMFC convened the Summer Flounder Overfishing Definition Review Committee to review these biological reference points. The work of this Committee was later reviewed by the MAFMC Scientific and Statistical Committee (SSC) in August 2001. The SSC recommended that using the FMSY proxy for Fmax = 0.26 was appropriate and should be retained for 2002, and endorsed the recommendation of SARC 31 (NEFSC 2000) which stated that “the use of Fmax as a proxy for FMSY should be reconsidered as more information on the dynamics of growth in relation to biomass and the shape of the stock recruitment function become available” (MAFMC 2001b).

The 2002 SAW 35 assessment (NEFSC 2002) indicated the summer flounder stock was overfished and overfishing was occurring relative to the biological reference points. The fishing mortality rate had declined from 1.32 in 1994 to 0.27 in 2001, marginally above the overfishing reference point (Fthreshold = Ftarget = Fmax = 0.26). Total stock biomass in 2001 was estimated at 42,900 mt (94.578 million lbs), or 19% below the biomass threshold (53,200 mt; 117.286 million lbs). The 2002 SAW35 Review Panel concluded that updating the biological reference points was not warranted at that time (NEFSC 2002). Subsequent updates to the stock assessment were completed in 2003 (Terceiro 2003), 2004 (SDWG 2004), and 2005 (NEFSC 2005). While the 2003 assessment found the summer flounder stock was not overfished and no overfishing was occurring, the 2004 and 2005 assessments found the stock again experiencing overfishing. The 2005 SAW 41 assessment provided updated values for the fishing mortality and stock biomass reference points (NEFSC 2005).

A peer review of the assessment occurred in 2006 by the NMFS Office of Science and Technology (S&T) (Terceiro 2006a, 2006b). This review made several recommendations, including modification of the definition of the overfished stock from the original definition under Amendment 2 to the FMP. Instead of using January 1 total stock biomass (TSB), the stock was considered overfished when November 1 spawning stock biomass (SSB) fell below one-half Spawning Stock Biomass at Maximum Sustainable Yield (SSBMSY) = 44,706 mt (98.6 million lbs). Further, the overfishing reference point was revised to be Fthreshold = Ftarget = Fmax = 0.28. The 2006 S&T assessment concluded that the stock was not overfished, but that overfishing was occurring relative to the updated reference points (Terceiro 2006b).

The 2007 assessment update (SDWG 2007) found that relative to the 2006 S&T assessment biological reference points, the stock was overfished and overfishing was occurring. The fishing mortality rate estimated for 2006 was 0.35, a significant decline from the 1.32 estimated for 1994 but still above the threshold of 0.28.

The most recent peer review of the assessment occurred at the 2008 SAW 47 (NEFSC 2008). In the 2008 SAW 47 assessment, the age-structured assessment model changed from an ADAPT virtual population analysis (VPA) model to a forward projecting, ASAP statistical catch at age (SCAA) model (NFT 2008a), and the fishery catch was modeled as two fleets: totals landings and total discards. A new value for the instantaneous natural mortality rate (M) was adopted, changing from a constant value of M = 0.20 to age- and sex-specific values that resulted in a mean value of M = 0.25. Biological reference points were therefore also revised; the proxy for FMSY changed from Fmax to F35%, and F40% was recommended as Ftarget. The assessment concluded that the stock was not overfished and overfishing was not occurring in 2007, relative to the revised biological reference points. Fishing mortality calculated from the average of the fully recruited ages (3-7+) ranged between 1.143 and 2.042 during 1982-1996. The fishing mortality rate was estimated to be 0.288 in 2007, below the fishing mortality reference point = F35% = FMSY = 0.310. SSB was estimated to be 43,363 mt (95.599 million lbs) in 2007, about 72% of the biomass target reference point of SSB35% = SSBMSY = 60,074 mt (132.441 million lbs). The assessment exhibited a consistent retrospective pattern of underestimation of F and overestimation of SSB, but no consistent retrospective pattern in recruitment.

The most recent assessment update in 2011 (Terceiro 2011) indicated that the stock was larger than the biomass target in 2010 (60,238 mt, 164 mt above SSBMSY). The 2011 update also found that the fishing mortality rate on the stock was below the fishing mortality threshold (0.216, about 30% below FMSY). Based on the 2011 assessment update, the NMFS determined on November 28, 2011, that the summer flounder was rebuilt in 2010.

This 2012 assessment update uses the same model as the 2008 SAW 47 (NEFSC 2008) and 2009-2011 updated (Terceiro 2009, 2010, 2011) assessments. Fishery and survey catches have been updated through 2011. Status determination is made by comparison to the 2008 SAW 47 biological reference points.

Summary of the history of the Summer Flounder, Scup, and Black Sea Bass FMP.

Year	Document	Plan Species	Management Action
1988	Original FMP	summer flounder	- Established management plan for summer flounder
1991	Amendment 1	summer flounder	- Established an overfishing definition for summer flounder
1993	Amendment 2	summer flounder	- Established rebuilding schedule, commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements for summer flounder - Created the Summer Flounder Monitoring Committee
1993	Amendment 3	summer flounder	- Revised the exempted fishery line - Increased the large mesh net threshold - Established otter trawl retention requirements
1993	Amendment 4	summer flounder	- Revised state-specific shares for summer flounder quota allocation

1993	Amendment 5	summer flounder	- Allowed states to combine or transfer commercial summer flounder quota
1994	Amendment 6	summer flounder	- Set criteria for allowance of multiple nets on board commercial vessels for summer flounder - Established deadline for publishing catch limits, commercial mgmt. measures for summer flounder
1995	Amendment 7	summer flounder	- Revised the F reduction schedule for summer flounder
1996	Amendment 8	summer flounder and scup	- Incorporated Scup FMP into Summer Flounder FMP and established scup measures including commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements
1996	Amendment 9	summer flounder and black sea bass	- Incorporated Black Sea Bass FMP into Summer Flounder FMP and established black sea bass measures including commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements
1997	Amendment 10	summer flounder, scup, and black sea bass	- Modified commercial minimum mesh requirements, continued commercial vessel moratorium, prohibited transfer of fish at sea, and established special permit for party/charter sector for summer flounder
1998	Amendment 11	summer flounder, scup, and black sea bass	- Modified certain provisions related to vessel replacement and upgrading, permit history transfer, splitting, and permit renewal regulations
1999	Amendment 12	summer flounder, scup, and black sea bass	- Revised FMP to comply with the SFA and established framework adjustment process
2001	Framework 1	summer flounder, scup, and black sea bass	-Established quota set-aside for research for all three species
2001	Framework 2	summer flounder	- Established state-specific conservation equivalency measures for summer flounder
2003	Amendment 13	summer flounder, scup, and black sea bass	- Addressed disapproved sections of Amendment 12 and included new EIS
2003	Framework 3	scup	- Allowed the rollover of winter scup quota - Revised start date for summer quota period for scup fishery
2003	Framework 4	scup	- Established system to transfer scup at sea
2004	Framework 5	summer flounder, scup, and black sea bass	- Established multi-year specification setting of quota for all three species
2006	Framework 6	summer flounder	- Established region-specific conservation equivalency measures for summer flounder
2007	Amendment 14	scup	- Established rebuilding schedule for scup
2007	Framework 7	summer flounder, scup, and black sea bass	- Built flexibility into process to define and update status determination criteria - Scup GRAs modifiable by framework adjustment

COMMERCIAL FISHERY LANDINGS

Total U.S. commercial landings of summer flounder from Maine to North Carolina peaked in 1979 at nearly 18,000 mt (39.561 million lbs, Table 1, Figure 1). The reported

landings in 2011 of 7,511 mt = 16.559 million lbs were about 94% of the final 2011 commercial quota. Since 1980, about 70% of the commercial landings of summer flounder have come from the Exclusive Economic Zone (EEZ; greater than 3 miles from shore). Large variability in summer flounder landings exist among the states, over time, and the percent of total summer flounder landings taken from the EEZ has varied widely among the states.

Northeast Region (NER; Maine to Virginia)

Annual commercial landings data for summer flounder in years prior to 1994 were obtained from detailed trip-level landings records contained in master data files maintained by the Northeast Fisheries Science Center (NEFSC; the "weighout system" of 1963-1993) and from summary reports of the Bureau of Commercial Fisheries and its predecessor the U.S. Fish Commission (1940-1962). Prior to 1994, summer flounder commercial landings were allocated to NEFSC 3-digit statistical area according to interview data (Burns et al. 1983). Beginning in 1994, landings estimates were derived from mandatory dealer reports under the current NMFS Northeast Region (NER) summer flounder quota monitoring system. Beginning in 1994, the dealer landings have been allocated to statistical area using fishing dealer and fishing Vessel Trip Reports (VTR data) in a multi-tiered allocation procedure at the fishing-trip level (Wigley et al., 2007). Three-digit statistical areas 537-539 (Southern New England), 611-616 (New York Bight), 621, 622, 625, and 626 (Delmarva region), and 631 and 632 (Norfolk Canyon area) have generally accounted for over 80% of the NER commercial landings since 1992 (Table 2).

A summary of length and age sampling of summer flounder landings collected by the NEFSC commercial fishery port agent system in the NER is presented in Table 3. For comparability with the manner in which length frequency sampling in the recreational fishery has been evaluated, sampling intensity is expressed in terms of metric tons (mt) of landings per 100 fish lengths measured. The sampling is proportionally stratified by market category (jumbo, large, medium, small, and unclassified), with the sampling distribution generally reflecting the distribution of commercial landings by market category. Overall sampling intensity has improved since 1995, from 165 mt per 100 lengths to less than 100 mt per 100 lengths, and temporal and geographic coverage has generally improved as well.

The age composition of the NER commercial landings for 1982-1999 was generally estimated semi-annually by market category and 1-digit statistical area (e.g., area 5 or area 6), using standard NEFSC procedures (market category length frequency samples converted to mean weights by length-weight relationships; mean weights in turn divided into landings to calculate numbers landed by market category; market category numbers at length apportioned to age by application of age-length keys). For 2000-2002, sampling was generally sufficient to make quarterly estimates of the age composition in area 6 for the large and medium market categories. Since 2003, sampling has generally been sufficient to make quarterly estimates of the age composition in areas 5 and 6 for the jumbo, large, and medium market categories. The proportion of large and jumbo market category fish (generally of ages 3 and older) in the NER landings has increased since 1996, while the proportion of small market category landings (generally of ages 0 and 1) has become very low (Table 4). The mean size of fish landed in the NER commercial fishery has been increasing since 1993, and has averaged about 1.04 kg (2.3 lbs) since 2007, typical of an age 4 summer flounder (Table 5).

North Carolina

The North Carolina winter trawl fishery accounts for about 99% of summer flounder commercial landings in North Carolina. A separate landings at age matrix for this component of

the commercial fishery was developed from North Carolina Division of Marine Fisheries (NCDMF) length and age frequency sample data. The NCDMF program samples about 10% of the winter trawl fishery landings annually, most recently at rates of less than 10 metric tons of landings per 100 lengths measured (Table 6). All length frequency data used in construction of the North Carolina winter trawl fishery landings at age matrix were collected in the NCDMF program; age-length keys from NEFSC commercial data and NEFSC spring survey data (1982-1987) and NCDMF commercial fishery data (1988 and later) were combined by appropriate statistical area and semi-annual period to resolve lengths to age. Fishery regulations in North Carolina also changed between 1987 and 1988, with increases in both the minimum mesh size of the codend and minimum landed fish size taking effect. It is not clear whether the change in regulations or the change in keys, or some combination, is responsible for the decreases in the numbers of age-0 and age-1 fish estimated in the North Carolina commercial fishery landings since 1987. Landed numbers at age and mean weight at age from this fishery are shown in Tables 7-8.

COMMERCIAL FISHERY DISCARDS

In the 1993 SAW 16 assessment, an analysis of variance of NER Fishery Observer data for summer flounder was used to identify stratification variables for an expansion procedure to estimate total landings and discards from the observer data kept and discard rates (weight per day fished) in the commercial fishery. Initial models included year, quarter, fisheries statistical division (2-digit area), area (divisions north and south of Delaware Bay), and tonnage class as main effects. Quarter and division consistently emerged as significant main effects without significant interaction with the year effect (NEFSC 1993). The estimation procedure expands transformation bias-corrected geometric mean catch (landings and discards) rates in year, quarter, and division strata by total days fished (days fished on trips landing any summer flounder by any mobile gear, including fish trawls and scallop dredges) to derive fishery landings and discards. The use of fishery effort as the multiplier (raising factor) allows estimation of landings from the fishery observer data for comparison with dealer reported landings, to help judge the potential accuracy of the procedure. For strata with no observer sampling, catch rates from adjacent or comparable strata were substituted as appropriate (except for Division 51, which generally has very low catch rates and negligible catch). Estimates of discard were stratified by 2 gear types (scallop dredges; trawls) for years when data were adequate (1992 and later years). The NER Fishery Observer sample data aggregated on an annual basis are summarized in Table 9.

While estimates of catch rates from the NER Fishery Observer data were used in this assessment to estimate total discards, catch rate information has also been reported in the NER Vessel Trip Report (VTR) data since 1994 (Table 10). A comparison of discard to total catch ratios for the Fishery Observer and VTR data sets for trawl and scallop dredge gear indicates similar discard rates from the two data sources through the 1990s. Since about 2000, Overall Fishery Observer and VTR discard to total catch ratios have diverged, with the Fishery Observer data generally indicating higher discard rates. Discard rates of summer flounder in the scallop dredge fishery were generally much higher than in the trawl fishery.

The change in mid-1994 from the interview/weighout data reporting system to the VTR/mandatory dealer report system required a change in the estimation of effort (days fished) to estimate total discards. An initial examination of days fished and catch per unit effort (CPUE; landings per day fished) for cod conducted at SAW 24 (NEFSC 1997a) compared these

quantities as reported in the full weighout and VTR data sets (DeLong et al., 1997). This comparison indicated a shift to a higher frequency of short trips (trips with one or two days fished reported), and to a mode at a lower rate of CPUE. It was not clear at SAW 24 if these changes were due to the change in reporting system (i.e., the units reported were not comparable), or real changes in the fishery, and so effort data reported by the VTR system were not used quantitatively in the SAW 24 assessments. In the 1997 SAW 25 assessment for summer flounder (NEFSC 1997b), a slightly different comparison was made. The port agent interview data for 1991-1993 and merged dealer/VTR data for 1994-1996, which under each system serve as the "sample" to characterize the total commercial landings, were compared in relative terms (percent frequency). For summer flounder, the percent frequency of short trips (lower number of days fished per trip) increased during 1991-1996, but not to the degree observed for cod, and the mode of CPUE rates for summer flounder increased in spite of lower effort per trip. For the summer flounder fishery, these may reflect actual changes in the fishery, due to increased restrictions on allowable landings per trip (trip landings limits might lead to shorter trips) and stock size increases (higher CPUE). As for cod, however, the influence of each of these changes (reporting system, management changes, and stock size changes) has not been quantified. Total days fished in the summer flounder fishery were comparable between the period from 1989-1993 and 1994. Since 1994, total days fished have ranged from 20,670 days in 1999 to 6,873 days in 2011 with a mean of about 10,000 days, a substantial decline relative to the 1989-1993 mean of 22,000 days. Because the effort measure is critical to the estimation of discards for summer flounder, the VTR data were used as the best data source to estimate summer flounder fishery days fished.

The approach described above was based only on the day fished data for ports in the NER during 1989-1996, and so it was necessary to raise the discard estimate to account for discarding occurring outside the NER reporting system (i.e., NER state reporting systems such as Connecticut, Virginia and North Carolina). To determine the proper raising factor, landings accounted for by the NER reporting system (which result from the fishing effort on which the fishery observer discard estimate is based) were compared with total NER landings, plus that portion of North Carolina landings from the EEZ (it is assumed that only the North Carolina fishery in the EEZ would experience significant discard, as mesh regulations in state waters have resulted in very low discards in state waters since implementation of the regulation in 1989; R. Monaghan, NCDMF; personal communication, June 30, 1997). As a result of this exercise, the total discard estimates were raised by 11 to 38% for 1989-1996. Since 1996, all states' landings and are included in the NER dealer reporting system, so no raising is necessary to account for missing landings.

Two additional adjustments were made to the dealer/VTR matched data subset days fished estimates to fully account for summer flounder fishery effort. First, the landings to days fished relationship in the matched set was assumed to be the same for unmatched trips, and so the days fished total in each discard estimation stratum (2-digit area and quarter) was raised by the dealer to matched set landings ratio. This step in the estimation accounted for days fished associated with trips landing summer flounder, and provided an estimate of discard for trips landing summer flounder. Given the restrictions on the fishery however, there is fishing activity which results in summer flounder discards, but no landings, especially in the scallop dredge fishery. The days fished associated with these trips was accounted for by raising strata discard estimates by the ratio of the total days fished on trips catching any summer flounder (trips with landings and discard, plus trips with discard only) to the days fished on trips landing summer flounder (trips with landings and discard). For this step, it is necessary to assume that the discard

rate (as indicated by the fishery observer data, which includes trips with discard but no landings, and which is used in previous estimation procedure steps) is the same for trips with only discards as for trips with both landings and discards.

Discard estimates are summarized in Table 11. Commercial fishery discard mortality in weight was highest in 1990-1991 and 1999 and lowest in 2009 and 2011. Scallop dredge fishery discard to landed ratios are much higher than trawl fishery ratios, purportedly because of closures and trip limits. Although the scallop dredge landings of summer flounder are less than 5% of the total, the discards of summer flounder are generally of the same order of magnitude as in the trawl fishery. Annual commercial fishery discard mortality estimated for 2006-2011 was less than 10% of the annual reported commercial landings.

Table 12 presents a comparison of commercial fishery dealer reported landings of summer flounder with estimates of summer flounder commercial landings from landings rates of NEFSC Fishery Observer sampling and commercial fishing effort (days fished) reported on commercial NER Vessel Trip Reports (VTR). Estimates of landings from observer data ranged from +53% (1999) to -81% (2011) of the reported landings in the fisheries, with live discards ranging from 36% (1990) to 2% (2011) of the dealer reported landings. Since 2003, the estimate of landings from the Observer data has averaged about 60% below the reported landings. An alternative discard estimation approach explored for the 2008 SAW 47 assessment provided no improvement in precision or "accuracy" of discard estimates through 2003, but the recent consistent trend since 2003 suggests the estimation procedure needs to be reconsidered in next benchmark assessment.

As recommended by SAW 16 (NEFSC 1993), a commercial fishery discard mortality rate of 80% was assumed to develop the final estimate of discard mortality (Table 11). The 2008 SAW 47 assessment (NEFSC 2008) considered some preliminary information from a 2007 Cornell University Cooperative Extension study which conducted ten scientific trips on inshore multispecies commercial trawling vessels to determine discard mortality rates relative to tow duration, fish size, and the amount of time fish were on the deck of the vessel. The median mortality for all tows combined was 78.7%, very close to the estimated overall discard mortality of 80% used in the assessment. The 2008 SAW 47 Review Panel recommended additional work be conducted to understand factors affecting discard mortality rates and the difference between the inshore (day-trip) and offshore (multi-day) components of the multispecies trawl fishery to facilitate future application of this information at a broader scale.

NER Fishery Observer data were used to develop estimates of commercial fishery discards since 1989. However, adequate data (e.g., interviewed trip data, survey data) are not available to develop summer flounder discard estimates for 1982-1988. Discard numbers were assumed to be very small relative to landings during 1982-1988 (because of the lack of a minimum size limit in the EEZ), but to have increased since 1989 with the implementation of fishery regulations in the EEZ. It was recognized that not accounting directly for commercial fishery discards in 1982-1988 would result in an underestimation of fishing mortality and population sizes in these years.

Discard estimates at length and age were stratified by gear for 1994-2000 and 2002-2011, again due to sample size considerations (Table 13). Only 11 fish were sampled from the sea scallop dredge fishery 2001, and so the scallop dredge discards were assumed to have the same length and age composition as the trawl fishery discards in 2001. NER Fishery Observer length frequency samples were converted to sample numbers at age and sample weight at age frequencies by application of NEFSC survey length-weight relationships and Fishery Observer, commercial fishery, and survey age-length keys. Sample weight proportions at age were next

applied to the raised fishery discard estimates to derive fishery total discard weight at age. Fishery discard weights at age were then divided by fishery observer mean weights at age to derive fishery discard numbers at age. Classification to age for 1989-1993 was done by semi-annual periods using Fishery Observer age-length keys, except for 1989, when first period lengths were aged using combined commercial landings (quarters 1 and 2) and NEFSC spring survey age-length keys. Since 1994, only NEFSC survey age-length keys were used, since Fishery Observer age-length keys were not yet available and commercial landings age-length keys contained an insufficient number of small summer flounder (<40 cm = 16 inches) that comprise most of the discards. Estimates of discarded numbers at age, mean length and mean weight at age are summarized in Tables 13-15.

The reason for discarding in the trawl and scallop dredge fisheries has been changing over time. During 1989 to 1995, the minimum size regulation was recorded as the reason for discarding summer flounder in over 90% of the observed trawl and scallop dredge tows. In 1999, the minimum size regulation was provided as the reason for discarding in 61% of the observed trawl tows, with quota or trip limits given as the discard reason in 26% of the observed tows, and high-grading in 11% of the observed tows. In the scallop fishery in 1999, quota or trip limits was given as the discard reason in over 90% of the observed tows. During 2000-2005, minimum size regulations were identified as the discard reason in 40-45% of the observed trawl tows, quota or trip limits in 25-30% of the tows, and high grading in 3-8%. In the scallop fishery during 2000-2005, quota or trip limits was given as the discard reason for over 99% of the observed tows. During 2006-2011, minimum size regulations were identified as the discard reason in 15-20% of the observed trawl tows, quota or trip limits in 60-70% of the tows, and high grading in 5-10%. In the scallop fishery during 2006-2011, quota or trip limits was given as the discard reason for about 40% of the observed tows, with about 50% reported as “unknown.” As a result of the increasing impact of trip limits, fishery closures, and high grading as reasons for discarding, the age structure of the summer flounder discards has also changed, with a higher proportion of older fish being discarded (Table 13).

RECREATIONAL FISHERY LANDINGS

Summary landings statistics for the summer flounder recreational fishery (catch type A+B1) as estimated by the NMFS Marine Recreational Fishery Statistics Survey (MRFSS) are presented in Tables 16-17. Recreational fishery landings increased 20% by number and 14% by weight from 2010 to 2011 and were about 50% under the 2011 recreational harvest limit.

The commercial fishery VTR system provides an alternative set of reported recreational landings by the party/charter boat sector. A comparison of VTR reports and MRFSS estimates indicates that MRFSS estimates are higher by a factor of 2-3 for the 1995-2011 period, with a generally increasing trend in recent years and ranging from a factor of 1.02 in 1998 to 5.47 in 2005 (Table 18). It is unclear if this is due mainly to under-reporting of party/charter boat recreational landings in the VTR system, or a systematic positive bias of MRFSS landings estimates for the party/charter boat sector.

Length frequency sampling intensity for the recreational fishery was calculated by MRFSS sub-regions (North - Maine to Connecticut; Mid - New York to Virginia; South - North Carolina) based on a metric tons of landings per hundred lengths measured basis (Burns et al.1983). For 2011, aggregate sampling intensity averaged 115 mt of landings per 100 fish measured (Table 19). To convert the recreational fishery length frequencies to age, MRFSS sample length frequency data, NEFSC commercial and survey age-length data were examined in

terms of number of fish measured/aged on various temporal and geographical bases. Correspondences were made between MRFSS intercept date (quarter), commercial quarter, and survey season (spring and summer/fall), and between MRFSS sub-region, commercial statistical areas, and survey depth strata to integrate data from the different sources. Based on the number, size range, and distribution of lengths and ages, a semi-annual, sub-regional basis of aggregation was adopted for matching of commercial and survey age-length keys with recreational length frequency distributions to convert lengths to ages. Limited MRFSS length sampling for larger fish resulted in a high degree of variability in mean length for older fish, especially at ages 5 and older during the first decade of the time series. Attempts to estimate length-weight relationships from the MRFSS biological sampling data provided unsatisfactory results. As a result, the commercial fishery quarterly length (mm) to weight (g) relationships from Lux and Porter (1966) were used to calculate annual mean weights at age from the estimated age-length frequency distribution of the landings.

The recreational landings historically were dominated by relatively young fish. During 1982-1996, age 1 fish accounted for over 50% of the landings by number and fish of ages 0 to 3 accounted for over 95% of landings by number. No fish from the recreational landings were determined to be older than age 7. With increases in the minimum landed size since 1996 (to 14.5 in [37 cm] in 1997, 15 in [38 cm] in 1998-1999, generally 15.5 in [39 cm] in 2000, and various state minimum sizes from 14.0 [36 cm] to 21 in [53 cm] in 2001-2011) and a trend to lower fishing mortality rates, the age composition of the recreational landings now includes mainly fish at ages 3 and older, at mean weights of greater than 1 kg per fish (Tables 20-21). The number of summer flounder of ages 3 and older landed by the recreational fishery in 2011, at over 98% of the landings by number, was the highest in the time series (Table 20).

RECREATIONAL FISHERY DISCARDS

MRFSS estimates of the percentage of live discard (catch type B2) to total catch (catch types A+B1+B2) in the recreational fishery for summer flounder has varied from about 18% (1985) to about 94% (2010) of the total catch (Table 22). To account for all removals from the summer flounder stock by the recreational fishery, some assumptions about the biological characteristics and discard mortality rate of the recreational live discard need to be made, because biological samples are not routinely taken of MRFSS catch type B2 fish. In previous assessments, data available from NYDEC surveys (1988-1992) of New York party boats suggested that nearly all (>95%) of the fish released alive from boats were below the minimum regulated size (during 1988-1992, 14 in [36 cm] in New York state waters), that nearly all of these fish were age 0 and age 1 summer flounder, and that these age 0 and 1 summer flounder occurred in about the same proportions in the live discard as in the landings. It was therefore assumed that all B2 catch would be of lengths below regulated size limits, and be either age 0 or age 1 in all three sub-regions during 1982-1996. Catch type B2 was allocated on a semi-annual, sub-regional basis in the same ratio as the annual age 0 to age 1 proportion observed in the landings during 1982-1996. Mean weights at age were assumed to be the same as in the landings during 1982-1996.

The minimum landed size in federal and most state waters increased to 14.5 in (37 cm) in 1997, to 15.0 in (38 cm) in 1998-1999, and to 15.5 in (39 cm) in 2000. Applying the same logic used to allocate the 1982-1996 recreational released catch to size and age categories during 1997-2000 implied that the recreational fishery released catch included fish of ages 2 and 3. Investigation of data from the Connecticut Department of Environmental Protection (CTDEP)

Volunteer Angler Survey (VAS) for 1997-1999 and from the American Littoral Society (ALS) for 1999, and comparing the length frequency of released fish in these programs with the MRFSS data on the length frequency of landed fish below the minimum size, indicated this assumption was valid for 1997-1999 (MAFMC 2001a). The CTDEP VAS and ALS data, along with data from the NYDEC Party Boat Survey (PBS), was used to validate this assumption for 2000. For 1997-2000 all B2 catch was assumed to be of lengths below regulated size limits, and therefore comprised of ages 0 to 3. Catch type B2 was allocated on a sub-regional basis in the same ratio as the annual age 0 to age 3 proportions observed in the landings at lengths less than 37 cm in 1997, 38 cm in 1998-1999, and 39 cm in 2000.

In 2001, many states adopted different combinations of minimum size and possession limits to meet management requirements. As a result, minimum sizes for summer flounder ranged from 15.5 in (39 cm) in federal, VA, and NC waters, 16 in (41 cm) in NJ, 16.5 in (42 cm) in MA, 17 in (43 cm) in MD and NY, to 17.5 in (44 cm) in CT, RI, and DE. Examination of data provided by MD sport fishing clubs, the CTDEP VAS, the ALS, and the NYDEC PBS indicated that the assumption that fish released are those smaller than the minimum size remained valid for 2001, and so catch type B2 was characterized by the same proportion at length as the landed catch less than the minimum size in the respective states. The differential minimum size by state has continued since 2001, and increased samples of the recreational fishery discards by state agency Volunteer Angler Surveys (VAS), the MRFSS For Hire Survey (MRF FHS), and the American Littoral Society (ALS) has allowed direct characterization the length frequencies of the discards from sample data and presumably a more accurate estimate of the discard in weight (Table 23).

Studies conducted to estimate recreational fishery discard mortality for striped bass and black sea bass suggest a rate of 8% for striped bass (Diodati and Richards 1996) and 5% for black sea bass (Bugley and Shepherd, 1991). Work by the states of Washington and Oregon with Pacific halibut (a potentially much larger flatfish species, but otherwise morphologically similar to summer flounder) found "average hooking mortality. . . between eight and 24 percent" (IPHC, 1988). An unpublished tagging study by the NYDEC (Weber MS 1984) on the survival of released sublegal summer flounder caught by hook-and-line suggested a total, non-fishing mortality rate of 53%, which included discard plus tagging mortality as well as deaths by natural mortality. Assuming deaths by natural mortality to be about 18%, (an instantaneous natural mortality rate of 0.20), an annual discard plus tagging mortality rate of about 35% can be derived from the NYDEC results.

In the 1997 SAW25 (NEFSC 1997b) and earlier assessments of summer flounder, a 25% discard mortality rate was assumed for summer flounder released alive by anglers. However, two subsequent investigations of summer flounder recreational fishery discard, or hooking, mortality suggested that a lower rate was more appropriate. Lucy and Holton (1998) used field trials and tank experiments to investigate the discard mortality rate for summer flounder in Virginia, and found rates ranging from 6% (field trials) to 11% (tank experiments). Malchoff and Lucy (1998) used field cages to hold fish angled in New York and Virginia during 1997 and 1998, and found a mean short term mortality rate of 14% across all trials. Given the results of these studies conducted specifically for summer flounder, a 10% discard mortality rate was adopted in the Terceiro (1999) stock assessment and has been retained in all subsequent assessments. Ten percent of the total B2 catch at age is therefore the basis of estimates of summer flounder recreational fishery discard mortality at age presented in Table 24. The mean weights at age of the recreational fishery discards are presented in Table 25.

MRIP ESTIMATES OF RECREATIONAL FISHERY CATCH

The NMFS Marine Recreational Fishery Statistics Survey (MRFSS) was replaced by the Marine Recreational Information Program (MRIP) in 2012 to provide improved recreational fishing statistics. The MRIP implemented a new statistical method for calculating recreational catch estimates, with many survey elements related to both data collection and analysis updated and refined to address issues such as data gaps, bias, consistency, accuracy, and timeliness. As part of the implementation of the MRIP, recreational fishery catch estimates for 2004-2011 have been directly replaced by those using the MRIP estimation methods. For earlier years, a constant "ratio of means" of the MRFSS and MRIP estimates has been used to adjust the recreational catch estimates.

For the recreational fishery harvest number (catch types A + B1), the largest change was for the state of NJ, with a cumulative 2004-2011 decrease of about 995,000 fish, or about -11%. The largest absolute increase was for the state of NY with a cumulative 2004-2011 increase of about 444,000 fish, or about +9%. The state of NH had the largest cumulative percentage decrease at -50%; however, NH's cumulative harvest (now about 1,300 fish) is less than 0.1% of the coastal total. The commonwealth of MA had the largest cumulative percentage increase at +20%, a cumulative increase of about 210,000 fish. Over all states, the cumulative harvest in numbers decreased by about 702,000 fish (about -3%), ranging from a decrease of 285,000 fish in 2007 (-8%) to an increase of 49,000 fish in 2011 (+3%; Tables 26-27). Therefore, for the years 1981-2003 recreational harvest in numbers was decreased by 3% for this assessment update.

For the recreational fishery harvest weight (catch types A + B1), the largest change was for the state of NJ, with a cumulative 2004-2011 decrease of about 1,229 mt, or about -11%. The largest absolute increase was for the state of NY with a cumulative 2004-2011 increase of about 967 mt, or about +12%. The state of NH had the largest cumulative percentage decrease at -50%; however, NH's cumulative harvest (now about 1 mt) is less than 0.1% of the coastal total. The commonwealth of MA had the largest cumulative percentage increase at +8%, a cumulative increase of about 115 mt. Over all states, the cumulative harvest in weight decreased by about 384 mt (about -1%), ranging from a decrease of 434 mt in 2007 (-8%) to an increase of 130 mt fish in 2005 (+3%; Tables 28-29). Therefore, for the years 1981-2003 recreational harvest in weight was decreased by 1% for this assessment update.

For the recreational fishery live releases in numbers (catch type B2), the largest change was for the state of NJ, with a cumulative 2004-2011 decrease of about 4 million fish, or about -6%. The largest absolute increase was for the state of NY with a cumulative 2004-2011 increase of about 513,000 fish, or about +1%. The state of MD had the largest cumulative percentage decrease at -28%, a cumulative increase of about 2.3 million fish. The state of ME had the largest cumulative percentage increase at +59%, a cumulative increase of about 24 fish; the next largest increases were for MA (+17%, 331,000 fish) and NH (+17%, 522 fish). Over all states, the cumulative live release in numbers decreased by about 6.5 million fish (about -4%), ranging from a decrease of 2.2 million fish in 2007 (-11%) to an increase of 411,000 fish in 2011 (+2%; Tables 30-31). Therefore, for the years 1981-2003 recreational live release and discard mortality estimates were decreased by 4% for this assessment update.

TOTAL CATCH COMPOSITION

NER commercial fishery landings and discards at age, North Carolina winter trawl fishery landings and discards at age, and MRFSS/MRIP recreational fishery landings and

discards at age totals were summed to provide a total fishery catch at age matrix for 1982-2011 (Table 32; Figure 2). The percentage of age 3 and older fish in the total catch in numbers has increased during the last decade from only 4% in 1993 to 72% in 2008, 68% in 2009, 69% in 2010, and 80% in 2011. Overall mean weight at age in the total catch was calculated as the weighted mean (by number in the catch at age) of the respective mean value at age from each fishery component (Table 33; Figure 3).

Commercial landings have accounted for 56% of the total catch since 1982, with recreational landings accounting for 36%, recreational discards 5%, and commercial discards about 3%. Since 2008 the comparable percentages are 58%, 29%, 11%, and 2%. Commercial discard losses in the otter trawl and scallop dredge fisheries have accounted for about 5% of the total commercial catch since 2008, assuming a discard mortality rate of 80%. Recreational discard losses have recently accounted for 20%-30% of the total recreational catch since 2008, assuming a discard mortality rate of 10% (Figure 4). Tables 34 and 35 provide tabulations of total catch in weight using MRFSS and MRIP estimates of the recreational fishery catch under the assumptions noted earlier.

RESEARCH SURVEY INDICES OF ABUNDANCE

Northeast Fisheries Science Center

Stratified random bottom trawl surveys have been conducted by the NEFSC between Cape Hatteras and Nova Scotia since 1968 (Clark 1979). NEFSC spring and fall survey indices suggest that total stock biomass peaked during 1976-1977 and again during 2003-2007 (Tables 36-37, Figure 5). The Fisheries Survey Vessel (FSV) *Albatross IV* (ALB) was replaced in spring 2009 by the FSV *Henry B. Bigelow* (HBB) as the main platform for NEFSC research surveys, including the spring and fall bottom trawl surveys. The size, towing power, and fishing gear characteristics of the HBB are significantly different from the ALB, resulting in different fishing power and therefore different survey catchability. Calibration experiments to estimate these differences were conducted during 2008 (Brown 2009), and the results of those experiments were peer reviewed by a Panel of three non-NMFS scientists during the summer of 2009 (Anonymous 2009, Miller et al. 2010). The terms of reference for the Panel were to review and evaluate the suite of statistical methods used to derive calibration factors by species before they were applied in a stock assessment context. Following the advice of the August 2009 Peer Review (Anonymous 2009), the methods proposed in Miller et al. (2010), and the precedents set in peer-reviews of stock assessments for haddock (Van Eeckhaute and Brooks 2010), yellowtail flounder (Legault et al. 2010), silver and red hake (NEFSC 2011a), and winter flounder (NEFSC 2011b) length-based calibration factors were used to convert 2009-2011 spring and fall HBB survey catch number and weight indices to ALB equivalents for use in this stock assessment update (Tables 37-39, Figure 5).

Age composition data from the NEFSC spring surveys indicate a substantial reduction in the number of ages in the stock between 1976-1990 (Table 40, Figure 6). For the period 1976-1981, fish of ages 5-8 were captured regularly in the survey, with the oldest individuals aged at 10-12 years. From 1982-1986, fish aged 5 years and older were only occasionally observed in the survey, and by 1986, the oldest fish observed in the survey were age 5. In 1990 and 1991, only three age groups were observed in the survey catch, and there was an indication that the 1988 year class was very weak. Since 1996, the NEFSC spring survey age composition has expanded significantly, with generally increasing abundance of age-3 and older fish up to age 12

for males and age 14 for females. Mean lengths at age from the NEFSC spring survey are presented in Table 41.

Summer flounder are frequently caught in the NEFSC fall survey at stations in inshore strata (< 27 meters = 15 fathoms = 90 feet) and at offshore stations in the 27-55 meter depth zone (15-30 fathoms, 90-180 feet) at about the same bathymetry as in the spring survey. NEFSC fall aggregate and at-age indices are presented in Tables 36-39 and 42. The NEFSC fall survey catches age-0 summer flounder in abundance, providing an index of summer flounder recruitment (Table 42, Figure 7). NEFSC fall survey indices suggest improved recruitment since the late 1980s, and an increase in abundance of age-2 and older fish since 1996. Mean lengths at age from the NEFSC fall survey are presented in Table 43.

A series of NEFSC winter trawl surveys was initiated in February 1992 to provide improved abundance indices for flatfish, including summer flounder. The surveys targeted flatfish concentrated offshore during the winter. A modified trawl was used that differed from the standard trawl employed during the NEFSC spring and fall surveys in that long trawl sweeps (wires) were added before the trawl doors to better herd fish to the mouth of the net, and the large rollers used on the standard gear were replaced on the footrope with a chain "tickler" and small spacing "cookies." The design and conduct of the winter survey (timing, strata sampled, and the use of the modified trawl gear) resulted in greater catchability of summer flounder compared to the other surveys. Most fish were captured in survey strata 61-76 (27-110 meters; 15-60 fathoms) off the Delmarva and North Carolina coasts. Other concentrations of fish were found in strata 1-12, south of the New York and Rhode Island coasts, in slightly deeper waters. Significant numbers of large summer flounder were often taken along the southern flank of Georges Bank (strata 13-18).

Indices of summer flounder abundance from the winter survey indicate stable stock size during 1992-1995, with catch per tow values ranging from 10.9 in 1995 to 13.6 in 1993 (Table 44). For 1996, the winter survey index increased by 290% over 1995, from 10.9 to 31.2 fish per tow. The largest increases in 1996 occurred in the Mid-Atlantic Bight region (offshore strata 61-76), where increases up to an order of magnitude occurred in several strata, with the largest increases in strata 61, 62, and 63 off the northern coast of North Carolina. Most of the increased catch in 1996 consisted of age-1 summer flounder from the 1995 year class. In 1997, the index dropped to 10.3 fish per tow, due to the lower numbers of age-1 (1996 year class) fish caught. From 1998-2003, the winter trawl survey indices increased; with the 2003 winter survey number and weight per tow indices being the highest in the time series at 27.58 kg/tow (Figure 5). The winter survey index was lower from 2004-2007, and values ranged from 10.3 to 15.9 fish per tow. Similar to the other NEFSC surveys, there is strong evidence since the mid-1990s of increased abundance of age-3 and older fish relative to earlier years in the time series (Tables 45-46). The NEFSC winter survey series ended in 2007.

Massachusetts Division of Marine Fisheries

Spring and fall bottom trawl surveys conducted by the Massachusetts Division of Marine Fisheries (MADMF) show a decline in abundance in numbers of summer flounder from high levels in 1986 to record lows in the early 1990s. Both the MADMF spring and fall indices then increased to record high levels in the mid-2000s, and have been relatively stable since then (Tables 47-48, Figure 8). The MADMF also captures a small number of age-0 summer flounder in a seine survey of estuaries, and these data constitute an index of recruitment (Table 49, Figure 9).

Rhode Island Department of Fish and Wildlife

Standardized spring and fall bottom trawl surveys have been conducted by the Rhode Island Department of Fish and Wildlife (RIDFW) since 1979 in Narragansett Bay and the state waters of Rhode Island Sound. Indices of abundance at age for summer flounder have been developed from the fall survey data using NEFSC fall survey age-length keys. The fall survey reached a time series high in 2009 and near high in 2011 (Table 50, Figure 8). An abundance index has also been developed from a set of fixed stations sampled monthly since 1990, which also reached a time series high in 2009 (Table 51). Recruitment indices are available from both the fall (Figure 9) and monthly fixed station surveys.

Connecticut Department of Environmental Protection

Spring and fall bottom trawl surveys are conducted by the Connecticut Department of Environmental Protection (CTDEP). The CTDEP surveys show a decline in abundance in numbers of summer flounder from 1986 to record lows in 1989. The CTDEP surveys indicate recovery since 1989, and evidence of increased abundance at ages 2 and older since 1995. The 2011 spring and 2002 fall indices were the highest in the respective time series. Due to vessel engine failure, no complete fall survey was conducted in 2010 (Tables 52-53, Figure 10). An index of recruitment is available from the fall series (Figure 7).

New Jersey Bureau of Marine Fisheries

The New Jersey Bureau of Marine Fisheries (NJBMF) has conducted a standardized bottom trawl survey since 1988, and indices of abundance for summer flounder are compiled from data collected from April through October (Table 54, Figure 11). The NJBMF survey mean number per tow indices and frequency distributions were converted to age using the corresponding annual NEFSC combined spring and fall survey age-length keys. The NJBMF index peaked in 2002 and has decreased since then. Over the last decade, most year classes are at or below average; however, the index of the 2005 year class was above average (Figure 12).

Delaware Division of Fish and Wildlife

The Delaware Division of Fish and Wildlife (DEDFW) has conducted a standardized bottom trawl survey with a 16 foot head-rope trawl since 1980 and with a 30 foot head-rope trawl since 1991. Recruitment indices (age 0 fish; one index from the Delaware estuary proper for 1980 and later, one from the inland bays for 1986 and later) have been compiled from the 16 foot trawl survey data (Tables 55-56, Figure 12). Indices for age-0 to age-4 and older summer flounder have been compiled from the 30 foot head-rope survey (Table 57, Figure 11). The indices use data collected from June through October (arithmetic mean number per tow) with age 0 summer flounder separated from older fish by visual inspection of the length frequency.

Maryland Department of Natural Resources

The Maryland Department of Natural Resources (MDDNR) has conducted a standardized trawl survey in the seaside bays and estuaries around Ocean City, MD since 1972. Samples collected during May to October with a 16 foot bottom trawl have been used to develop a recruitment index for summer flounder (Table 58, Figure 13). This index suggests that weakest year class in the time series recruited to the stock in 1988 and 2005, and the strongest in 1972, 1983, 1986, 1994, and 2009.

Virginia Institute of Marine Science

The Virginia Institute of Marine Science (VIMS) has conducted a juvenile fish survey using trawl gear in Virginia rivers since 1955. An index of recruitment developed from the VIMS survey suggests weak year classes (<0.2 fish per trawl) recruited to the stock in 1955, 1959, 1961-1962, 1966, 1968, 1970, and 1975, with strong year classes (>2.0 fish per trawl) recruiting in 1956-57, 1963, 1971, 1979-1983, 1990-1991, and 1994. Recruitment indices since 1994 have been below average (Table 59, Figure 13).

The VIMS Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMap) survey was started in 2002, providing research survey samples from Chesapeake Bay. The ChesMMap samples are dominated by age 0-2 summer flounder. The ChesMMAP indices, developed since the last benchmark assessment in 2008, have not yet been included in the calibration of the ASAP population model (Table 60, Figure 14).

The VIMS Northeast Area Monitoring and Assessment Program (NEAMAP) survey was started in Fall 2007, providing research survey samples along the Atlantic Coastal waters from Rhode Island to North Carolina, in depths of 20-90 feet (9-43 meters). The NEAMAP indices, developed since the last benchmark assessment in 2008, have not yet been included in the calibration of the ASAP population model (Tables 61-62, Figure 14).

North Carolina Divisions of Marine Fisheries

The North Carolina Divisions of Marine Fisheries (NCDMF) has conducted a stratified random trawl survey using two 30 foot headrope nets with 3/4" mesh codend in Pamlico Sound since 1987. An index of recruitment developed from these data suggests the weakest year class recruited to the stock in 1988, with the strongest year classes in 1987, 1996, 2001, and 2002 (Table 63, Figure 13). The survey normally takes place in mid-June, but in 1999 was delayed until mid-July. The 1999 index is therefore inconsistent with the other indices in the time series, and so the 1999 value has been excluded.

BIOLOGICAL DATA

Aging

Work performed for the SAW 22 assessment (NEFSC 1996b) indicated a major expansion in the size range of 1-year old summer flounder collected during the 1995 and 1996 NEFSC winter bottom trawl surveys. This also brought to light differences between ages determined by NEFSC and NCDMF fishery biology staffs; therefore, age structure (scale) exchanges were performed after the SAW 22 assessment to explore these differences. The results of the first two exchanges indicated low levels of agreement between age readers at the NEFSC and NCDMF (31 and 46%). In 1996, research was conducted to determine inter-annular distances and to back-calculate mean length at age from scale samples collected on all NEFSC bottom trawl surveys (winter, spring and fall) for comparison with NCDMF samples. While mean length at age remained relatively constant from year to year, inter-annular distances increased sharply in the samples from the 1995-1996 winter surveys, and increased to a lesser degree in samples from other 1995-1996 surveys. As a result, further exchanges were suspended pending the resolution of an apparent aging problem.

Age samples from the winter 1997 bottom trawl survey, aged utilizing both scales and otoliths by only by one reader, indicated a similar pattern as the previous two winter surveys (i.e., several large age 1 individuals), and some disagreement between scale and otolith ages

obtained from the same fish. Because of these problems, a team of five experienced NEFSC readers re-examined the scales aged from the winter 1997 survey. After reviewing several hundred scales, the team determined that re-aging all samples from 1995-1997 would be appropriate, including all winter, spring, and fall samples from the NEFSC and MADMF bottom trawl surveys and all samples from the commercial fishery. The age determination criteria remained the same as those developed at the 1990 summer flounder workshop (Almeida et al. 1992) and described in the aging manual utilized by NEFSC staff (Dery 1997). Only those fish for which a 100% agreement of all team members was attained were included in the revised database, however. The data from the re-aged database were used in analyses in the SAW 25 assessment (NEFSC 1997b).

A third summer flounder aging workshop was held at the NEFSC in 1999 to continue the exchange of age structures and review of aging protocols for summer flounder (Bolz et al. 2000). Participants at this workshop concluded that the majority of aging disagreements arose from the interpretation of marginal scale increments due to highly variable timing of annulus formation, and from the interpretation of first year growth patterns and first annulus selection. The workshop recommended regular samples exchanges between NEFSC and NCDMF, and further analyses of first year growth. Subsequently, Sipe and Chittenden (2001) concluded that sectioned otoliths were the best structure for aging summer flounder over the age range from 0 to 10 years. Since 2001, both scales and otoliths have routinely been collected in all NEFSC trawl surveys for fish larger than 60 cm, and studies are underway to determine the best structure to use for aging these large summer flounder. An exchange of NEFSC and NCDMF aging structures for summer flounder occurred again in 2006. This exchange examined samples from fish aged 1 to 9 (23-76 cm total length) and determined that the consistency of aging between NCDMF and the NEFSC was at an acceptable level.

Maturity

The maturity schedule for summer flounder used in the 1990 SAW 11 and subsequent stock assessments through 1999 was developed by the 1990 SDWG using NEFSC Fall Survey maturity data for 1978-1989 and mean lengths at age from the NEFSC fall survey (G. Shepherd, NEFSC, personal communication, July 1, 1990; NEFC 1990; Terceiro 1999). The 1990 SAW 11 work indicated that the median length at maturity (50^{th} percentile, L_{50}) was 25.7 cm for male summer flounder, 27.6 cm for female summer flounder, and 25.9 cm for the sexes combined. Under the aging convention used in the 1990 SAW 11 and subsequent assessments (Smith et al. 1981, Almeida et al. 1992, Szedlmayer and Able 1992, Bolz et al. 2000), the median age of maturity (50^{th} percentile, A_{50}) for summer flounder was determined to be 1.0 years for males and 1.5 years for females. Combined maturities indicated that at peak spawning time in the fall, 38% of age-0 fish are mature, 72% of age-1 fish are mature, 90% of age-2 fish are mature, 97% of age-3 fish are mature, 99% of age-4 fish are mature, and 100% of age-5 and older fish are mature. The maturities for age-3 and older were rounded to 100% in the 1990 SAW 11 and subsequent assessments.

It has been noted that the NEFSC maturity schedules have been based on simple gross morphological examination of the gonads that may overestimate the true spawning potential of the summer flounder stock, especially for age-0 and age-1 fish. A research recommendation that the true spawning contribution of young summer flounder to the SSB be investigated was included in the 1993 SAW 16 assessment (NEFSC 1993). University of Rhode Island (URI) studies to address this research recommendation were completed in 1999 (Specker et al 1999, Merson et al 2000). In light of the URI results, the NEFSC maturity data for summer flounder for

1982-1998 were examined in the 2000 SAW 31 assessment (NEFSC 2000) to determine if changes in the maturity schedule were warranted.

The URI work examined the histological and biochemical characteristics of female summer flounder oocytes to determine if age-0 and age-1 female summer flounder produce viable eggs, and to develop an improved guide for classifying the maturity of summer flounder collected in NEFSC surveys. The URI studies examined 333 female summer flounder (321 aged fish) sampled during the NEFSC Winter 1997 Bottom Trawl Survey (February 1997) and 227 female summer flounder (210 aged fish) sampled during the NEFSC fall 1997 bottom trawl survey (September 1997) using radioimmunoassay to quantify the biochemical cell components characteristic of mature fish (Specker et al. 1999, Merson et al. 2000).

The NEFSC and URI maturity determinations disagreed for 13% of the 531 aged fish, with most (10%) of the disagreement due to NEFSC mature fish classified as immature by the URI histological and biochemical criteria. The URI criteria indicated that 15% of the age-0 fish were mature, 82% of the age-1 fish were mature, 97% of the age-2 fish were mature, and 100% of the age 3 and older fish were mature. When the proportions of fish mature at length and age were estimated by probit analysis, median length at maturity (50^{th} percentile, L_{50}) was estimated to be 34.7 cm for female summer flounder, with the following proportions mature at age: age-0: 30%, age-1: 68%, age-2: 92%, age-3: 98%, and age-4: 100%. Median age of maturity (50^{th} percentile, A_{50}) was estimated to be about 0.5 years. Based on this new information, the 2000 SAW 31 (NEFSC 2000) considered 5 options for the summer flounder maturity schedule for the assessment:

(1) No change, use the maturity schedule for combined sexes as in the 1990 SAW 11 and subsequent assessments (rounded to 0.38, 0.72, 0.90, 1.00, 1.00, and 1.00 as in the 1997 SAW 25 and Terceiro (1999) assessment analyses).

(2) Consider only age-2 and older fish of both sexes in the SSB.

(3) Knife edged, age-1 and older maturity for both sexes. This would eliminate age-0 fish of both sexes from the SSB, and assume that the proportions mature at age-1 “round” to 100%.

(4) NEFSC 1982-1989, 1990-1998 for both sexes, assuming a 1:1 sex ratio in deriving a combined schedule.

(5) NEFSC 1982-1989, 1990-1998 for males, URI study for females, assuming a 1:1 sex ratio in deriving a combined schedule.

The 5 options produce the following maturity schedules for both sexes combined:

Option			Age			
	0	1	2	3	4	5+
1	0.38	0.72	0.90	1.00	1.00	1.00
2	0.00	0.00	0.90	1.00	1.00	1.00
3	0.00	1.00	1.00	1.00	1.00	1.00
4	0.45, 0.45	0.88, 0.82	0.97, 0.93	1.00, 0.98	1.00, 0.99	1.00, 1.00
5	0.29, 0.31	0.74, 0.76	0.95, 0.94	0.99, 0.98	1.00, 1.00	1.00, 1.00

The 2000 SAW 31 assessment concluded that some contribution to spawning from ages 0 and 1 should be included, eliminating options 2 and 3. The differences among remaining options 1, 4, and 5 were considered to be relatively minor, and so the 1990 SAW 11 schedule (Option 1) was retained for subsequent assessments (MAFMC 2001a, NEFSC 2002b). The 2000 SAW 31 recommended that more biochemical and histological work should be done to verify that results of the URI studies would be applicable in the future. The 2000 SAW 31 also noted the need for research to explore whether the viability of eggs produced by young, first time spawning summer flounder is comparable to the viability of eggs produced by older, repeat spawning summer flounder (NEFSC 2000). In the 2005 SAW 41 work (NEFSC 2005), the maturity schedule was updated and broadened to include data from 1992-2004, covering the year range for individually measured and weighed fish sampled in NEFSC research surveys. The resulting combined sex maturity schedule (0.38, 0.91, 0.98, 1.00, 1.00, and 1.00; respectively for age-0 to 5+) was retained in the 2006 assessment and S&T peer review (Terceiro 2006b). The 2008 SDWG examined the proportions of summer flounder mature at age from 1981-2007 as well as individual fish information on length and age at maturity from 1992-2007, and concluded that it was appropriate to retain the maturity schedule from the 2006 assessment for the 2008 SAW47 assessment (NEFSC 2008). The 2006 schedule was retained in the 2009, 2010 (Terceiro 2009, 2010) and current updated assessments.

Natural Mortality Rate (M)

In the 1996 SAW 20 assessment (NEFSC 1996a), estimates of M were derived using methods described by 1) Pauly (1980) using growth parameters derived from NCDMF age-length data and a mean annual bottom temperature (17.5^{o}C) from NC coastal waters, 2) Hoenig (1983) using a maximum age for summer flounder of 15 years and 3) consideration of age structure expected in unexploited populations (5% rule, 3/M rule, e.g., Anthony 1982). The 1996 SAW 20 concluded that M = 0.2 was a reasonable value given the mean (0.23) and range (0.15-0.28) obtained from the various analyses, and this value for M had been used in all assessments through 2007.

For the 2008 SAW 47 assessment (NEFSC 2008), sex and age-specific estimates of M were calculated from summer flounder age and growth data (1976-2007) from the NEFSC trawl surveys. Longevity based estimators of M are sensitive to underlying assumptions which include the terminal proportion of the population surviving to a given maximum age and the maximum observed age under no or low exploitation conditions. Using a maximum age of 15 years for summer flounder, the Hoenig (1983) and Hewitt and Hoenig (2005) longevity based estimates of M for combined sexes ranged from 0.20 to 0.36, depending on whether terminal proportion of 1.5% or 5% was assumed. Other life-history based models were examined and included Pauly (1980), Jensen (1996), Gunderson and Dygert (1988), and Gunderson (1997), with estimates ranging from 0.20 to 0.45. Age-specific and size variable estimates of M, based on the work of Peterson & Wroblewski (1984), Chen & Watanabe (1989), Lorenzen (1996), and Lorenzen (2000), ranged from 0.19 to 0.90, with the highest values obviously associated with age-0-1 fish (fish at smaller lengths). While these exercises provided a wide range of methods and M estimates to be considered, each estimate involved a suite of underlying assumptions which were debated. In addition, the assessment modeling frameworks considered in the 2008 SAW 47 assessment (ADAPT VPA, ASAP SCAA, and SS2 SCAA) allowed for log-likelihood profiling of M to determine which M estimate provided the best model fit. The M that minimized the log-likelihood was 0.35, 0.20, and 0.25 under the ADAPT VPA, ASAP SCAA, and SS2 SCAA

models, respectively. The estimate of M that resulted in the best diagnostic value was sensitive to model selection and configuration, as the data inputs were similar across the three models.

The 2008 SAW47 Review Panel considered the different approaches to estimating M and after lengthy discussion assumed a natural mortality rate (M) of 0.20 for females and 0.30 for males, based mainly on recently observed maximum ages in the NEFSC survey data of 14 years (76 cm, in NEFSC Winter Survey 2005) for females and 12 years (63 cm, in NEFSC Spring Survey 2007) for males, and the expectation that larger and older fish would likely be observed if future fishing mortality rates are maintained near current rates (< F = 0.3). A combined sex M-schedule at age was developed by assuming these initial M rates by sex, an initial proportion of females at age 0 of 0.40 derived from the NEFSC Fall survey indices by age and sex, and population abundance decline over time at the sex specific M rates. The final abundance weighted combined sex M-schedule at age ranged from 0.26 at age 0 to 0.24 at age 7+, with a mean of 0.25. This M-schedule was retained in the 2009-2010 (Terceiro 2009, 2010) and current updated assessments.

2011 UPDATED FISHING MORTALITY RATE AND STOCK SIZE ESTIMATES

Fishing mortality rates and stock sizes were estimated using the ASAP statistical catch at age model (NFT 2008a). The catch at age, mean weights at age, maturity at age, and survey index calibration time series were input as in the 2008 SAW 47 assessment. An age-specific instantaneous natural mortality rate providing an average M = 0.25 was assumed for all years. Winter, spring, and mid-year survey indices and all survey recruitment (age-0) indices were compared to population numbers of the same age at the beginning of the same year. Fall survey indices were compared to population numbers one year older at the beginning of the next year. Lognormal error distributions were assumed for the total catch in weight, research survey catch at age calibration indices, internal Beverton-Holt stock-recruitment relationship and parameters, selectivity parameters, annual fishing mortality parameters, survey catchability parameters, and estimated stock numbers at age. A multinomial distribution was assumed for fishery catch at age. A number of additional initial model settings including specification of likelihood component emphasis factors (lambdas), size of deviation factors expressed as standard deviations, and penalty functions for extreme fishing mortality estimates were set at consensus values by the 2008 SDWG after multiple sensitivity runs to evaluate a range of inputs.

The annual selection of age-1 fish decreased from about 0.4 during the first time block of selectivity estimation (1982-1994) to about 0.1 during the second block, 1995-2011. The annual selection of age-2 fish decreased from about 1.0 during the first time block of selectivity estimation (1982-1994) to about 0.5 during the second block, 1995-2011. These decreases in selection at age are in line with expectations given changes in commercial and recreational fishery regulations. For these reasons, summer flounder are currently considered to be fully recruited to the fisheries at age 3, and fully recruited fishing mortality is expressed as the unweighted average of fishing mortality at age for ages 3 to 7+.

Summary results for the 2011 updated assessment are provided in Table 64, and population number and fishing mortality estimates at age are provided in Tables 65-66. The 2011 update indicates that fishing mortality ranged between 1.0 and 2.0 during 1982-1996. The fishing mortality rate has declined to below 1.0 since 1997 and was estimated to be 0.241 in 2011 (Figure 15). There is a 50% probability that the fishing mortality rate in 2011 was between 0.228 and 0.254 (Figure 16). The summer flounder stock assessment has historically exhibited a

retrospective pattern of underestimation of F; the causes of this pattern have not been determined. For the last 5 terminal years, however, fishing mortality has been retrospectively overestimated (Figure 17). Over the last 7 terminal years, the annual internal model retrospective error in fishing mortality has ranged from +14% in the 2009 terminal year to -35% in 2004.

Spawning stock biomass (SSB) decreased from about 25,000 mt in the early 1980s to about 7,000 in 1989, then increased to above 40,000 mt by 2002. SSB was estimated to be 57,020 mt in 2011, 5% below the SSBMSY = SSB35% reference point = 60,074 mt (Table 64, Figures 18-19). There is a 50% probability that SSB in 2011 was between 54,440 and 59,822 mt (Figure 20). The assessment has historically exhibited a retrospective pattern of overestimation of SSB; the causes of this pattern have not been determined. For the last 6 terminal years, however, SSB has been retrospectively underestimated (Figure 21). Over the last 7 terminal years, the annual internal model retrospective error in SSB has ranged from -17% in the 2006 terminal year to +25% in 2004.

The arithmetic average recruitment from 1982 to 2011 is 42 million fish at age 0. The 1981 and 1982 year classes are the largest in the historical assessment time series, at 72 and 81 million fish; the 1988 year class is the smallest at 13 million fish. The 2009 year class is currently estimated to be about 47 million fish, about 10% above average (Table 54, Figures 18-19). The current estimate of the size of the 2009 year class is about 50% smaller than the initial estimate from the 2010 assessment of 80 million fish. Both the 2010 and 2011 year classes are estimated to be smaller than average. A recent pattern of overestimation in recruitment is evident from the retrospective analysis (Figure 22; note that model age 1 is true age 0). Over the last 7 terminal years, the annual internal model retrospective error in recruitment has ranged from +83% for the 2009 year class to -24% for the 2005 year class. The estimates of SSB, R and F from the last five assessments are consistent with the most recent internal retrospective pattern of the assessment model (Figures 23-25).

BIOLOGICAL REFERENCE POINTS (BRPS)

Background

The calculation of biological reference points for summer flounder based on yield per recruit analysis using the Thompson and Bell (1934) model was first detailed in the 1990 SAW 11 assessment (NEFC 1990). The 1990 analysis estimated that Fmax = 0.230. In the 1997 SAW 25 assessment (NEFSC 1997b) an updated yield per recruit analysis reflecting the fishery selection pattern and mean weights at age for 1995-1996 estimated that Fmax = 0.240. The Overfishing Definition Review Panel (Applegate et al. 1998) recommended that the MAFMC base MSY proxy reference points on yield per recruit analysis and this recommendation was adopted in formulating the FMP Amendment 12 Overfishing Definition (MAFMC 1999). These reference points were based on the 1999 assessment (Terceiro 1999) and followed what would later be described as the anon-parametric approach (i.e., biomass reference points calculated as the product of biomass per recruit and a reference period recruitment level; NEFSC 2002a). The analysis in the Terceiro (1999) assessment, reflecting fishery selection and mean weights at age for 1997-1998, indicated that Fthreshold = Ftarget= Fmax = 0.263, yield per recruit (Y/R) at Fmax was 0.55219 kg/recruit, and January 1 Total Stock Biomass per recruit (TSB/R) at Fmax was 2.8127 kg/recruit. The median number of summer flounder recruits estimated from the 1999 assessment for 1982-1998 was 37.8 million age-0 fish. Based on this median recruitment level, maximum sustainable yield (Ymax as a proxy for MSY) was estimated to be 20,897 mt (46.070 million lbs) at a Total Stock Biomass (TSBmax as a proxy for BMSY) of 106,444 mt (234.669

million lbs). The biomass threshold, one-half TSBmax as a proxy for one-half BMSY, was therefore estimated to be 53,222 mt (117.334 million lbs). The Terceiro (1999) reference points were retained in the 2000 SAW 31 assessment (NEFSC 2000) because of the stability of the input data and resulting biological reference point estimates.

The MAFMC SSC conducted a peer review of the summer flounder Overfishing Definition in concert with the 2001 assessment (MAFMC 2001a, b). The 2001 SSC reviewed six analyses estimating biological reference points for summer flounder that were conducted by members of the Summer Flounder Biological Reference Point Working Group. The 2001 SSC decided that although the new analyses conducted by the Working Group had resulted in a wide range of estimates, they did not provide a reliable alternative set of reference points for summer flounder. The 2001 SSC therefore recommended that Ftarget remain at the Terceiro (1999) estimate of Fmax = 0.263 because a better estimate had not been established by any of the new analyses. The 2001 SSC also reviewed the biomass target (BMSY) and threshold (one-half BMSY) components of the Overfishing Definition and concluded that the new analyses did not justify an alternative estimate of the BMSY proxy. The 2001 SSC endorsed the recommendations of the 2000 SAW 31 which stated that Athe use of Fmax as a proxy for FMSY should be reconsidered as more information on the dynamics of growth in relation to biomass and the shape of the stock recruitment function become available (NEFSC 2000). The 2001 SSC agreed that additional years of stock and recruitment data should be collected and encouraged further model development, including model evaluation through simulation studies. They also encouraged the evaluation of alternative proxies for biological reference points that might be more appropriate for an early maturing species like summer flounder and the development and evaluation of management strategies for fisheries where BMSY is unknown. The 2001 SSC indicated that as the stock size increases, population dynamic processes that could reflect density dependent mechanisms should be more closely monitored and corresponding analyses should be expanded, i.e., rates of size and age, maturity, fecundity, and egg viability should be closely monitored as potential indicators of compensation at higher stock sizes. Finally, the 2001 SSC recommended that potential environmental influences on recruitment, including oceanographic changes and predation mortality, should be reevaluated as additional recruitment data become available. As a result of the 2001 SSC peer review (MAFMC 2001a) the Terceiro (1999) reference points were retained in the 2001 stock assessment (MAFMC 2001b). In the review of the 2002 stock assessment (NEFSC 2002b), SAW 35 concluded that revision of the reference points was not warranted at that time due to the continuing stability of the input data and resulting reference point estimates. The Terceiro (1999) reference points were subsequently retained in the 2003 (Terceiro 2003) and 2004 (SDWG 2004) assessments.

The biological reference points for summer flounder were next peer-reviewed by the 2005 SAW 41, using fishery data through 2004 and research survey data through 2004/2005 (NEFSC 2005). The SAW 41 Panel noted that the Beverton-Holt (Beverton and Holt, 1957; Mace and Doonan 1988; BH) model fit the observed stock-recruitment data well, and provided reference points comparable to those derived from a non-parametric (yield and biomass per recruit) approach. The SAW 41 Panel noted, however, that the quantity of observed stock-recruitment data was limited (22 years), and the data during the early part of the time series, when the SSB was at the lowest observed levels, indicated a level of recruitment near the estimated Rmax, and exerted a high degree of leverage on the estimation of the model parameters. This leverage resulted in a high value (0.984) for the calculated steepness (h) of the BH curve, outside of the $\pm$ one standard error interval of the estimate for Pleuronectid flatfish (0.8 ± 0.1) indicated by Myers et al. (1999). The BH model results suggested that summer

flounder SSB could fall to very low levels (<2,000 mt) and still produce recruitment near that produced at SSBMSY. The SAW 41 Panel concluded a) that this result might not be reasonable for the long term, given the recent stock-recruitment history of the stock (i.e., production of a very poor year class in 1988), b) the BH model estimated parameters might prove to be sensitive to subsequent additional years of S-R data, especially if they accumulated at higher levels of SSB and recruitment in the near term, and c) the BH model fit might also be sensitive to the magnitude of recently estimated spawning stock and recruitment, given the recent retrospective pattern of overestimation of stock size evident in the assessment. Given these concerns, the SAW 41 Panel advised that the BH model estimates were not suitable for use as biological reference points for summer flounder, and recommended continued use of reference points developed using the non-parametric model approach. FMP biological reference points from the 2005 assessment were Fmax = FMSY = 0.276, Ymax = MSY = 19,072 mt (42.047 million lbs), TSBmax = BMSY = 92,645 mt (204.247 million lbs), and biomass threshold of 0.5*TSBmax = 46,323 mt (102.125 million lbs; NEFSC 2005).

The biological reference points for summer flounder were peer-reviewed again in 2006 by the National Marine Fisheries Service (NMFS) Office of Science and Technology (S&T) (Methot 2006). The 2006 S&T Peer Review recommended using SSB, rather than TSB as in previous assessments, as the metric for the biomass reference point proxy. The product of the mean recruitment (37.0 million fish) and Y/R at Fmax was 21,444 mt = 47.276 million lbs (as the proxy for MSY); the product of the mean recruitment and SSB/R at Fmax was 89,411 mt = 197.118 million lbs (as the proxy for BMSY; Terceiro 2006a, b). The 2006 S&T Peer Review Panel (Methot 2006) recommended adoption of these biological reference points from the non-parametric approach for summer flounder, advising:

> The low level of recruitment observed in 2005 is essentially the same as the low 1988 recruitment, so it is within the range of recruitment fluctuation used in calculating the expected time to rebuild this stock. The Panel finds that the most representative approach to calculating BRPs and rebuilding rates would be to use the entire set of recruitments from 1982-2005. The average, not median, of these recruitments should be used for calculation of biological reference points because much of the stock's accumulated biomass comes from the larger recruitments. Random draws from this set of recruitments would provide a probability distribution of rebuilding rates that is consistent with the occasional occurrence of small recruitments (1988 and 2005) and large recruitments (1982-1987). There is no documented and obvious reason why recruitments were higher during 1982-1987. If such recruitment levels become more common as the stock rebuilds, then the stock may rebuild to an even higher level than is currently targeted. If such recruitment levels do not occur during the next few years of the rebuilding, then the rebuilding target may be not be achieved by the target time to rebuild. More precise forecasts than this are not feasible.

The two biological reference point estimation approaches previously used in the 2005 SAW 41 (NEFSC 2005) and 2006 S&T Peer Review (Terceiro 2006b) assessments were again applied in the 2008 SAW 47 benchmark assessment work (NEFSC 2008), so as to be potentially complementary and supportive and because using both should build confidence in the results. Objective application of either approach is often compromised by lack of sufficient observation on stock and recruitment over a range of biomass to provide suitable contrast. Thus, it is often necessary to extrapolate beyond the range of observation and to infer the shape of the stock-recruit relationship from limited and variable observations (NEFSC 2002a). The 2001 MAFMC SSC review of summer flounder reference points also noted this concern (MAFMC 2001a).

The non-parametric approach was to evaluate various statistical moments (mean, variance, percentiles) of the observed series of recruitment data and apply the estimated spawning stock biomass and yield per recruit associated with common F reference points to

derive the implied spawning stock biomass and equilibrium total yield (landings plus discards). The biomass and yield per recruit models were fit using the NOAA Fisheries Toolbox (NFT) YPR version 2.7.2 software (NFT 2008b). The full time series of recruitment during 1982-2007 as estimated in the 2008 SAW47 assessment was used in the yield and spawning stock biomass calculations at fishing mortality reference points, as per the 2006 S&T Peer Review Panel recommendation. The non-parametric approach assumes that compensatory mechanisms such as impaired growth, maturity, or recruit survival are negligible over the range of biomass considered (NEFSC 2002a). Once the Fmax reference point (i.e., the Fmax proxy for FMSY) was determined, a long-term (100 year) stochastic projection of stock sizes and catches was done to provide better consistency between the estimated medians of the BRP calculations and shorter-term (e.g., 1-5 year) projections (Legault 2008).

The parametric approach used fitted parametric stock-recruitment models along with yield and spawning biomass per recruit information to calculate MSY-based reference points following the procedure of Sissenwine and Shepherd (1987). Stock-recruitment models were fit using the NFT SRFIT version 6.3 software (NFT 2008c). Since a wide range of models (Beverton-Holt [BH] and Ricker [RK] models, incorporating autoregressive error, and Bayesian priors for various parameters) had been tested in the 2005 SAW 41 work, the 2008 SAW47 parametric model exercise was limited to the simple Beverton-Holt and Ricker models (Beverton and Holt 1957, Mace and Doonan 1988, Ricker 1954).

2008 SAW 47 Biological Reference Points (BRPs)

For the 2008 SAW 47 assessment, the ASAP SCAA model provided the basis for the 2008 biological reference points and stock status. Average values of mean weights at age in the catch and stock, maturity schedule, and fishery selection pattern for the period 2005-2007 were used as input for ages 0-7+ for BRP calculations. In previous assessments (NEFSC 2005 and earlier) for older aged fish (ages 8-15) with very limited or missing samples, Gompertz functions based on younger ages were used to estimate mean weights for the older ages in the BRP calculations. However, the practice of extending the age structure to age 15 and use of Gompertz weights for the older ages resulted in inconsistency between the BRP biomass estimates based on long-term stochastic projections and shorter-term (e.g., 1-5 year) projections used for Total Allowable Landings (TAL) calculations (NEFSC 2002a, Legault 2008). Therefore, to increase consistency between these two types of projections, the age range of the BRP and projection calculations was set at 0-7+, with 8 additional ages (to age 15) included in the plus group calculation of yield and spawning biomass per recruit (NFT 2008b). The mean weight at age for the plus group (ages 7+) was updated for the 2008 SAW47 assessment in a new way, by using a weighted average of mean weights for ages 7-15 (observed catch weights for ages 7-10; calculated weights for ages 11-15 as estimated from observed ages 0-10) based on the relative proportions at age given a 2007 total mortality rate of 0.55 (mean M = 0.25 + 2007 F = 0.30; this value is coincidently consistent with the F35% proxy for FMSY). The combined effects of the new assumption for M and the modeling of landings and discards as distinct fleets (which resulted in a slightly domed-shaped combined fishery selectivity pattern) resulted in higher estimates of F reference points, lower estimates of MSY, lower estimates of SSB reference points, and improved stock status with respect to both the F and SSB reference points, as compared to the S&T 2006 assessment.

The reference points estimated from the parametric approach were suspect because the Beverton-Holt function steepness (h) parameters were always very near 1.0. Therefore Fmax, F40%, and F35% (and their corresponding biomass reference points) from the non-parametric

approach were considered as candidate proxies for FMSY and BMSY. Fmax had been used in previous assessments as the proxy for FMSY. The estimate of Fmax using mean M = 0.25 and updated fishery selectivity and mean weights at age was relatively high (0.558) and the YPR to F relationship did not indicate a well defined peak. As a result, little gain in YPR (<5%) was realized at fishing mortality rates higher than F35% = 0.310. However, the corresponding decline in SSBR between F35% = 0.310 (~1.48 kg/r) and Fmax = 0.558 (~0.93 kg/r) was about 37%. The 2008 SAW47 concluded that F40% = 0.254 and F35% = 0.310 were candidate proxies that provided sufficient YPR (F40% YPR = 92% of Fmax YPR; F35% YPR = 97% of Fmax YPR) to allow for productive fisheries while also providing for substantial SSBR (F40% SSBR = 176% of Fmax SSBR; F35% SSBR = 155% of Fmax SSBR) to buffer against short-term declines in recruitment. Recommended proxies for FMSY and SSBMSY were F35% = 0.310 and the associated MSY (13,122 mt = 28.929 million lbs) and SSBMSY (60,074 mt = 132.440 million lbs) estimates from long-term stochastic projections. F40% = 0.254 was recommended as a fishing mortality rate target for management. These 2008 SAW47 BRPs were subsequently adopted by the NMFS and MAFMC in the 2009 fishery regulation specification process, and have retained in the 2009-2011 (Terceiro 2009, 2010, 2011) and current updated assessments to evaluate stock status.

2011 UPDATED STOCK STATUS

The summer flounder stock was not overfished and overfishing was not occurring in 2011 relative to the biological reference points established in the 2008 SAW 47 assessment. The fishing mortality rate was estimated to be 0.241 in 2011, below the threshold fishing mortality reference point = FMSY = F35% = 0.310. SSB was estimated to be 57,020 mt = 125.708 million lbs in 2011, 5% below the biomass target reference point = SSBMSY = SSB35% = 60,074 mt (132.440 million lbs; Table 64, Figure 26). The NMFS determined in November 2011 that the summer flounder stock reached the biomass target (i.e., was rebuilt) in 2010, based on the 2011 assessment update.

PROJECTION OF THE OVERFISHING LIMIT (OFL) FOR 2013

Stochastic projections were made to provide forecasts of stock size and catches in 2012-2013 consistent with the 2008 SAW47 biological reference points. The projections do not explicitly account for the recent retrospective pattern in the assessment, as per the 2006 S&T Peer Review advice (Methot 2006, Terceiro 2006a, 2006b). The projections assume that recent (2009-2011) patterns of fishery selectivity, discarding, maturity at age and mean weight at age will continue over the time span of the projections. One hundred projections were made for each of the 1000 Markov Chain Monte Carlo (MCMC) realizations of 2012 stock sizes using NFT AGEPRO version 4.0.1 (NFT 2011). Future recruitment at age 0 was generated randomly from a cumulative density function of the updated recruitment series for 1982-2011 (mean recruitment = 42.5 million fish).

If the landings of summer flounder in 2012 equal the specified Total Allowable Landings (TAL) = 10,238 mt = 22.571 million lbs, the 2012 median (50% probability) discards are projected to be 1,455 mt = 3.208 million lbs, and the median total catch is projected to be 11,693 mt = 25.779 million lbs. The median F in 2012 is projected to be 0.247, below the fishing mortality threshold = FMSY = F35% = 0.310. The median SSB on November 1, 2012 is

projected to be 55,300 mt = 121.916 million lbs, below the biomass target of SSBMSY = SSB35% = 60,074 mt = 132.440 million lbs.

If the stock is fished at the fishing mortality threshold = FMSY = F35% = 0.310 in 2013, median landings are projected to be 11,892 mt = 26.217 million lbs, with median discards of 1,637 mt = 3.609 million lbs, and median total catch = 13,523 mt = 29.813 million lbs. This projected median total catch is equivalent to the Overfishing Limit (OFL) for 2013, and is less than the MSY = 14,632 mt (32.258 million lbs) of total catch (13,122 mt = 28.929 million lbs of landings plus 1,510 mt = 3.329 million lbs of discards). The median SSB on November 1, 2013 is projected to be 52,843 mt = 116.499 million lbs, below the biomass target of SSBMSY = SSB35% = 60,074 mt = 132.440 million lbs. The projected catch estimates in the following table are medians of the catch distributions for fixed F in 2013.

Total Catch (OFL), Landings, Discards, Fishing Mortality (F)
and Spawning Stock Biomass (SSB) in 2013
Catches and SSB in metric tons

Total Catch	Landings	Discards	F	SSB
13,523	11,892	1,637	0.310	52,843

MAJOR SOURCES OF ASSESSMENT UNCERTAINTY

(1) The landings from the commercial fisheries used in this assessment assume no under reporting of summer flounder landings. Therefore, reported landings from the commercial fisheries should be considered minimal estimates.

(2) The recreational fishery landings and discards used in the assessment are estimates developed from the Marine Recreational Fishery Statistics Survey (MRFSS) and Marine Recreational Information Program (MRIP; NRC 2000). While the estimates of summer flounder catch are considered to be among the most reliable produced by the MRFSS and MRIP, they are subject to error.

(3) The current estimate of M remains an ongoing source of uncertainty. M is highly influential on the assessment results and has a “rescaling affect” on SSB, F, R, point calculations, and the associated perception of current stock status.

(4) Estimation of the mean weight at age for older fish (i.e. age 10+) remains an ongoing source of uncertainty.

(5) Sex specific differences in life history parameters may affect the results of the assessment model.

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Table 1. Summer flounder commercial landings by state (thousands of lb) and coastwide (thousands of pounds (>000 lbs), metric tons (mt)). * = less than 500 lb; na = not available

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	Total '000 lbs	Total mt
1940	0	0	2,847	258	149	1,814	3,554	3	444	1,247	498	10,814	4,905
1941	na	na	na	na	na	na	na	na	183	764	na	947	430
1942	0	0	193	235	126	1,286	987	2	143	475	498	3,945	1,789
1943	0	0	122	202	220	1,607	2,224	11	143	475	498	5,502	2,496
1944	0	0	719	414	437	2,151	3,159	8	197	2,629	498	10,212	4,632
1945	0	0	1,730	467	270	3,182	3,102	2	460	1,652	1,204	12,297	5,578
1946	0	0	1,579	625	478	3,494	3,310	22	704	2,889	1,204	14,305	6,489
1947	0	0	1,467	333	813	2,695	2,302	46	532	1,754	1,204	11,146	5,056
1948	0	0	2,370	406	518	2,308	3,044	15	472	1,882	1,204	12,219	5,542
1949	0	0	1,787	470	372	3,560	3,025	8	783	2,361	1,204	13,570	6,155
1950	0	0	3,614	1,036	270	3,838	2,515	25	543	1,761	1,840	15,442	7,004
1951	0	0	4,506	1,189	441	2,636	2,865	20	327	2,006	1,479	15,469	7,017
1952	0	0	4,898	1,336	627	3,680	4,721	69	467	1,671	2,156	19,625	8,902
1953	0	0	3,836	1,043	396	2,910	7,117	53	1,176	1,838	1,844	20,213	9,168
1954	0	0	3,363	2,374	213	3,683	6,577	21	1,090	2,257	1,645	21,223	9,627
1955	0	0	5,407	2,152	385	2,608	5,208	26	1,108	1,706	1,126	19,726	8,948
1956	0	0	5,469	1,604	322	4,260	6,357	60	1,049	2,168	1,002	22,291	10,111
1957	0	0	5,991	1,486	677	3,488	5,059	48	1,171	1,692	1,236	20,848	9,456
1958	0	0	4,172	950	360	2,341	8,109	209	1,452	2,039	892	20,524	9,310
1959	0	0	4,524	1,070	320	2,809	6,294	95	1,334	3,255	1,529	21,230	9,630
1960	0	0	5,583	1,278	321	2,512	6,355	44	1,028	2,730	1,236	21,087	9,565
1961	0	0	5,240	948	155	2,324	6,031	76	539	2,193	1,897	19,403	8,801
1962	0	0	3,795	676	124	1,590	4,749	24	715	1,914	1,876	15,463	7,014
1963	0	0	2,296	512	98	1,306	4,444	17	550	1,720	2,674	13,617	6,177
1964	0	0	1,384	678	136	1,854	3,670	16	557	1,492	2,450	12,237	5,551
1965	0	0	431	499	106	2,451	3,620	25	734	1,977	272	10,115	4,588
1966	0	0	264	456	90	2,466	3,830	13	630	2,343	4,017	14,109	6,400
1967	0	0	447	706	48	1,964	3,035	0	439	1,900	4,391	12,930	5,865
1968	0	0	163	384	35	1,216	2,139	0	350	2,164	2,602	9,053	4,106
1969	0	0	78	267	23	574	1,276	0	203	1,508	2,766	6,695	3,037
1970	0	0	41	259	23	900	1,958	0	371	2,146	3,163	8,861	4,019
1971	0	0	89	275	34	1,090	1,850	0	296	1,707	4,011	9,352	4,242
1972	0	0	93	275	7	1,101	1,852	0	277	1,857	3,761	9,223	4,183
1973	0	0	506	640	52	1,826	3,091	*	495	3,232	6,314	16,156	7,328
1974	*	0	1,689	2,552	26	2,487	3,499	0	709	3,111	10,028	22,581	10,243
1975	0	0	1,768	3,093	39	3,233	4,314	5	893	3,428	9,539	26,311	11,934
1976	*	0	4,019	6,790	79	3,203	5,647	3	697	3,303	9,627	33,368	15,135
1977	0	0	1,477	4,058	64	2,147	6,566	5	739	4,540	10,332	29,927	13,575
1978	0	0	1,439	2,238	111	1,948	5,414	1	676	5,940	10,820	28,586	12,966
1979	5	0	1,175	2,825	30	1,427	6,279	6	1,712	10,019	16,084	39,561	17,945

Table 1, continued. Summer flounder commercial landings by state (thousands of lb) and coastwide (thousands of pounds (>000 lbs), metric tons (mt)). * = less than 500 lb; na = not available

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	Total '000 lbs	Total mt
1980	4	0	367	1,277	48	1,246	4,805	1	1,324	8,504	13,643	31,216	14,159
1981	3	0	598	2,861	81	1,985	4,008	7	403	3,652	7,459	21,056	9,551
1982	18	*	1,665	3,983	64	1,865	4,318	8	360	4,332	6,315	22,928	10,400
1983	84	0	2,341	4,599	129	1,435	4,826	5	937	8,134	7,057	29,548	13,403
1984	2	*	1,488	4,479	131	2,295	6,364	9	813	9,673	12,510	37,765	17,130
1985	3	*	2,249	7,533	183	2,517	5,634	4	577	5,037	8,614	32,352	14,675
1986	0	*	2,954	7,042	160	2,738	4,017	4	316	3,712	5,924	26,866	12,186
1987	8	*	3,327	4,774	609	2,641	4,451	4	319	5,791	5,128	27,052	12,271
1988	5	0	2,421	4,719	741	3,439	6,006	7	514	7,756	6,770	32,377	14,686
1989	9	0	1,878	3,083	513	1,464	2,865	3	204	3,689	4,206	17,913	8,125
1990	3	0	628	1,408	343	405	1,458	2	138	2,144	2,728	9,257	4,199
1991	0	0	1,124	1,672	399	719	2,341	4	232	3,715	3,516	13,722	6,224
1992	*	*	1,383	2,532	495	1,239	2,871	12	319	5,172	2,576	16,599	7,529
1993	6	0	903	1,942	225	849	2,466	6	254	3,052	2,894	12,599	5,715
1994	4	0	1,031	2,649	371	1,269	2,356	4	179	3,091	3,571	14,525	6,588
1995	5	0	1,128	2,325	319	1,248	2,319	4	174	3,304	4,555	15,381	6,977
1996	8	0	800	1,763	266	936	2,369	8	266	2,286	4,218	12,920	5,861
1997	3	0	745	1,566	257	823	1,321	5	215	2,370	1,501	8,806	3,994
1998	6	0	707	1,712	263	822	1,863	11	224	2,616	2,967	11,190	5,076
1999	6	0	813	1,637	245	804	1,918	8	201	2,196	2,801	10,627	4,820
2000	7	0	789	1,703	240	800	1,848	12	252	2,206	3,354	11,211	5,085
2001	22	0	694	1,800	267	751	1,745	7	223	2,660	2,789	10,958	4,970
2002	1	0	1,009	2,286	357	1,053	2,407	3	327	2,970	4,078	14,491	6,573
2003	0	0	926	2,178	272	1,073	2,384	6	329	3,492	3,559	14,219	6,450
2004	0	0	1,193	3,085	406	1,594	2,831	8	284	3,906	4,834	18,141	8,228
2005	3	0	1,274	2,926	449	1,804	2,529	5	333	3,869	4,059	17,253	7,826
2006	7	0	910	2,120	314	1,262	2,346	4	248	2,669	3,926	13,806	6,262
2007	3	0	660	1,515	207	939	1,698	3	178	2,025	2,669	9,897	4,489
2008	1	0	647	1,469	223	858	1,544	1	199	1,764	2,424	9,133	4,143
2009	0	0	732	1,794	244	1,140	1,799	0	166	1,993	2,819	10,689	4,848
2010	0	0	852	2,289	305	1,364	2,165	0	221	2,625	3,253	13,074	5,930
2011	0	0	1,131	2,825	397	1,513	2,830	1	259	4,783	2,822	16,561	7,511

Table 2. Distribution of Northeast Region (Maine to Virginia) commercial fishery landings by statistical area.

Area	1992	1993	1994	1995	1996	1997	1998	1999
511	0	0	0	0	1	0	0	0
512	0	0	0	0	1	1	0	0
513	0	3	0	0	2	0	0	2
514	9	11	10	12	3	15	17	11
515	0	0	0	0	0	0	0	0
521	8	3	14	4	16	2	9	2
522	8	8	7	6	13	6	2	3
561	2	1	0	0	1	1	3	2
562	6	4	5	10	1	1	0	3
525	22	35	26	85	140	16	27	28
526	294	242	193	128	45	22	33	17
533	0	0	0	0	6	2	3	5
537	916	557	707	770	553	449	417	354
538	228	255	341	332	273	270	229	275
539	217	157	223	258	248	284	373	418
611	117	35	181	283	170	141	204	230
612	404	393	169	221	353	297	316	403
613	237	167	280	242	188	194	128	171
614	81	97	141	129	18	41	41	13
615	61	15	49	99	20	37	41	44
616	532	476	743	730	474	245	280	122
621	1028	526	258	279	325	266	286	304
622	299	363	323	522	264	53	141	301
623	0	6	0	14	28	0	1	0
625	289	227	122	118	282	227	142	91
626	743	601	821	347	395	94	502	415
631	655	98	219	220	21	174	258	140
632	160	77	60	43	75	30	41	79
635	45	45	77	55	29	418	228	97
636	0	0	0	4	2	27	8	20
Total	6361	4402	4969	4911	3947	3313	3730	3550

Table 2, continued. Distribution of Northeast Region (Maine to Virginia) commercial fishery landings by statistical area.

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
511	1	0	0	0	1	0	0	0	0	0
512	1	0	0	0	3	0	1	3	0	1
513	0	1	0	1	1	5	1	0	0	2
514	2	1	2	2	3	14	4	3	2	3
515	0	0	3	1	2	0	0	0	0	4
521	4	15	31	12	11	12	3	4	3	5
522	6	5	12	10	18	10	14	3	13	6
561	4	7	8	1	0	1	1	0	0	1
562	8	3	24	9	5	11	3	4	2	1
525	41	29	43	32	67	93	38	40	9	22
526	16	23	23	17	36	75	25	20	7	4
533	10	2	1	2	6	6	4	6	3	2
537	326	337	446	451	875	860	635	475	419	532
538	260	214	257	275	290	223	255	203	182	234
539	455	432	543	551	500	455	386	276	353	272
611	142	155	206	217	317	389	369	299	228	265
612	308	379	613	606	685	611	603	422	414	551
613	170	162	241	240	319	284	304	191	151	205
614	3	11	26	25	30	48	12	33	31	15
615	70	115	90	63	87	68	126	94	69	43
616	384	247	218	359	600	722	524	574	486	426
621	208	274	533	303	397	270	285	179	247	297
622	101	234	153	394	614	424	360	34	203	297
623	8	18	3	14	28	74	22	3	0	62
625	60	129	296	261	156	326	123	121	12	30
626	697	510	648	763	899	880	331	197	174	153
631	185	142	189	119	13	68	13	70	18	97
632	39	41	8	82	39	54	31	12	1	9
635	54	212	99	21	9	1	8	12	16	30
636	1	7	5	4	27	1	0	0	0	1
Total	3564	3705	4723	4835	6036	5985	4481	3278	3043	3570

Table 2, continued. Distribution of Northeast Region (Maine to Virginia) commercial fishery landings by statistical area.

Area	2010	2011
511	138	0
512	0	1
513	8	1
514	5	22
515	0	0
521	30	39
522	14	19
561	0	8
562	0	7
525	49	72
526	10	7
533	0	8
537	651	974
538	161	192
539	206	357
611	203	413
612	519	682
613	261	430
614	36	106
615	76	284
616	571	1205
621	744	309
622	353	443
623	0	66
625	104	269
626	255	387
631	33	45
632	5	6
635	24	17
636	1	0
Total	4455	6369

Table 3. Summary of sampling of the commercial fishery for summer flounder, Northeast Region (Maine to Virginia); landings in metric tons (mt).

Year	Lengths	Ages	ME-VA Landings (mt)	Sampling Intensity (mt/100 lengths)
1982	8,194	2,288	7,536	92
1983	6,893	1,347	10,202	148
1984	5,340	1,794	11,455	215
1985	6,473	1,611	10,767	166
1986	7,840	1,967	9,499	121
1987	6,605	1,788	9,945	151
1988	9,048	2,302	11,615	128
1989	8,411	1,325	6,217	74
1990	3,419	853	2,962	87
1991	4,627	1,089	4,626	100
1992	3,385	899	6,361	188
1993	3,638	844	4,402	121
1994	3,950	956	4,969	126
1995	2,982	682	4,911	165
1996	4,580	1,235	3,947	86
1997	8,855	2,332	3,313	37
1998	10,055	2,641	3,730	37
1999	10,460	3,244	3,550	34
2000	10,952	3,307	3,564	33
2001	10,310	2,838	3,705	36
2002	7,422	1,870	4,723	64
2003	8,687	2,210	4,835	56
2004	13,970	3,560	6,036	43
2005	17,188	4,903	5,985	35
2006	18,118	5,062	4,481	25
2007	19,581	6,247	3,278	17
2008	14,803	4,661	3,043	20
2009	18,560	4,694	3,570	19
2010	15,185	3,510	4,455	29
2011	16,587	3,121	6,232	38

Table 4. Commercial landings at age of summer flounder ('000), Northeast Region (Maine to Virginia).

Year	0	1	2	3	4	5	6	7	8	9	10	Total	7+
1982	1441	6879	5630	232	61	97	57	22	2	0	0	14421	24
1983	1956	12119	4352	554	30	62	13	17	4	2	0	19109	23
1984	1403	10706	6734	1618	575	72	3	5	1	4	0	21121	10
1985	840	6441	10068	956	263	169	25	4	2	1	0	18769	7
1986	407	7041	6374	2215	158	93	29	7	2	0	0	16326	9
1987	332	8908	7456	935	337	23	24	27	11	0	0	18053	38
1988	305	11116	8992	1280	327	79	18	9	5	0	0	22131	14
1989	96	2491	4829	841	152	16	3	1	1	0	0	8430	2
1990	0	2670	861	459	81	18	6	1	1	0	0	4097	2
1991	0	3755	3256	142	61	11	1	1	0	0	0	7227	1
1992	114	5760	3575	338	19	22	0	1	0	0	0	9829	1
1993	151	4308	2340	174	29	43	19	2	1	0	0	7067	3
1994	119	3698	3692	272	64	12	6	0	5	0	0	7868	5
1995	46	2565	4280	239	39	8	2	1	0	0	0	7180	1
1996	0	1401	3187	798	156	15	3	0	1	0	0	5561	1
1997	0	380	2442	1214	261	69	10	4	0	0	0	4380	4
1998	0	196	1719	2022	437	72	15	1	0	0	0	4462	1
1999	0	123	1569	1522	585	160	26	8	0	0	0	3993	8
2000	0	212	1934	1083	449	119	47	15	6	1	1	3867	23
2001	0	706	1402	1000	331	155	59	16	4	1	2	3676	23
2002	0	406	2706	1375	383	133	75	9	0	1	0	5088	10
2003	0	470	2112	1353	532	255	110	39	17	2	1	4891	59
2004	0	287	2609	1765	748	301	120	58	32	6	4	5930	100
2005	0	506	1373	1629	1091	675	364	182	127	38	24	6009	371
2006	0	375	2221	1110	578	276	132	49	19	3	1	4764	72
2007	0	160	762	1449	485	225	115	43	16	6	4	3265	69
2008	0	135	452	692	951	339	147	70	32	9	4	2831	115
2009	0	164	728	1005	775	521	164	63	29	10	4	3463	106
2010	0	223	704	1203	1210	542	244	95	51	28	8	4308	182
2011	0	101	761	1870	1675	869	326	173	86	28	19	5907	306

Table 5. Mean weight (kg) at age of summer flounder landed in the commercial fishery, Northeast Region (ME-VA).

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1982	0.260	0.420	0.620	1.840	2.330	2.940	2.710	4.040	5.990	0.000	0.000	0.545
1983	0.310	0.460	0.800	1.400	2.350	1.850	2.760	3.300	4.170	4.370	0.000	0.562
1984	0.280	0.390	0.600	1.090	1.430	2.160	3.210	3.620	4.640	4.030	0.000	0.540
1985	0.330	0.440	0.590	1.080	1.730	2.220	2.590	4.710	4.780	4.800	0.000	0.587
1986	0.300	0.440	0.630	1.110	1.760	1.890	3.140	2.960	4.810	0.000	0.000	0.629
1987	0.270	0.450	0.620	1.060	2.000	2.850	3.080	3.020	4.140	0.000	0.000	0.590
1988	0.360	0.460	0.600	1.210	2.070	2.880	3.980	3.910	4.500	0.000	0.000	0.596
1989	0.357	0.554	0.738	1.062	1.833	2.466	3.568	3.592	2.251	0.000	0.000	0.736
1990	0.000	0.518	0.857	1.374	1.835	2.134	3.212	3.915	5.029	0.000	0.000	0.724
1991	0.000	0.482	0.748	1.538	2.257	3.012	3.908	3.873	0.000	0.000	0.000	0.642
1992	0.340	0.500	0.820	1.880	2.680	3.090	0.000	4.590	0.000	0.000	0.000	0.672
1993	0.354	0.488	0.751	1.625	2.099	1.786	2.810	4.136	5.199	0.000	0.000	0.623
1994	0.389	0.552	0.616	1.426	2.266	3.083	3.323	0.000	3.703	0.000	0.000	0.632
1995	0.328	0.542	0.704	1.532	2.373	2.916	3.500	4.094	0.000	0.000	0.000	0.684
1996	0.000	0.544	0.577	1.137	1.881	2.845	3.776	0.000	4.762	0.000	0.000	0.694
1997	0.000	0.544	0.637	0.842	1.310	2.101	2.559	3.429	0.000	4.853	5.004	0.756
1998	0.000	0.550	0.643	0.845	1.386	2.307	2.524	3.983	0.000	0.000	0.000	0.837
1999	0.000	0.523	0.615	0.862	1.359	1.928	2.838	3.618	0.000	0.000	0.000	0.888
2000	0.000	0.566	0.676	0.972	1.459	2.125	2.514	2.600	3.303	3.357	3.707	0.924
2001	0.000	0.588	0.762	1.031	1.721	2.376	2.847	3.566	3.898	3.806	5.499	1.009
2002	0.000	0.596	0.711	1.006	1.652	2.162	2.845	3.601	3.357	2.983	0.000	0.927
2003	0.000	0.611	0.705	0.998	1.414	1.890	2.528	3.181	3.535	3.560	4.964	0.989
2004	0.000	0.555	0.716	0.995	1.427	1.914	2.488	2.984	3.138	3.635	3.911	1.018
2005	0.000	0.556	0.627	0.793	1.056	1.385	1.692	1.989	2.274	3.098	3.375	0.996
2006	0.000	0.580	0.651	0.935	1.319	1.788	2.333	2.828	3.253	3.991	3.727	0.941
2007	0.000	0.559	0.683	0.866	1.202	1.696	2.256	2.424	2.724	3.256	4.183	1.002
2008	0.000	0.563	0.636	0.804	1.103	1.497	1.933	2.265	2.588	2.914	3.425	1.074
2009	0.000	0.536	0.635	0.803	1.051	1.509	1.927	2.523	2.899	3.288	3.670	1.029
2010	0.000	0.436	0.566	0.768	1.036	1.408	2.127	2.493	2.798	3.114	3.831	1.034
2011	0.000	0.475	0.551	0.687	1.015	1.538	1.939	2.453	2.864	3.055	3.819	1.057

Table 6. Summary of North Carolina Division of Marine Fisheries (NCDMF) sampling of the commercial trawl fishery for summer flounder; landings in metric tons (mt).

Year	Lengths	Ages	Landings (mt)	Sampling Intensity (mt/100 lengths)
1982	5,403	0	2,864	53
1983	8,491	0	3,201	38
1984	14,920	0	5,674	38
1985	13,787	0	3,907	28
1986	15,754	0	2,687	17
1987	12,126	0	2,326	19
1988	13,377	189	3,071	23
1989	15,785	106	1,908	12
1990	15,787	191	1,237	8
1991	24,590	534	1,595	6
1992	14,321	364	1,168	8
1993	18,019	442	1,313	7
1994	21,858	548	1,620	7
1995	18,410	548	2,066	11
1996	17,745	477	1,913	11
1997	12,802	388	681	5
1998	21,477	476	1,346	6
1999	11,703	412	1,271	11
2000	24,177	568	1,521	6
2001	19,655	499	1,265	6
2002	21,653	609	1,841	8
2003	17,476	610	1,615	9
2004	20,436	553	2,182	11
2005	20,598	620	1,827	9
2006	20,911	682	1,781	9
2007	26,187	697	1,211	5
2008	27,703	749	1,100	4
2009	19,580	723	1,279	7
2010	23,142	783	1,476	6
2011	16,962	417	1,282	8

Table 7. Commercial landings at age of summer flounder (‘000), North Carolina commercial trawl fishery.

Year	0	1	2	3	4	5	6	7	8	9	10	Total	7+
1982	981	3463	1021	142	52	19	6	4	2	0	0	5690	6
1983	492	3778	1581	287	135	41	3	3	1	0	0	6321	4
1984	907	5658	3889	550	107	18	1	0	0	0	0	11130	0
1985	196	2974	3529	338	85	24	5	1	0	0	0	7152	1
1986	216	2478	1897	479	29	32	1	1	1	0	0	5134	2
1987	233	2420	1299	265	25	1	0	0	0	0	0	4243	0
1988	0	2917	2225	471	227	39	1	6	1	0	0	5887	7
1989	2	49	1437	716	185	37	1	2	0	0	0	2429	2
1990	2	143	730	418	117	12	1	1	0	0	0	1424	1
1991	0	382	1641	521	116	20	2	0.4	0	0	0	2682	0
1992	0	36	795	697	131	21	2	0.03	0	0	0	1682	0
1993	0	515	1101	252	44	1	0.2	0	0	0	0	1913	0
1994	6	258	1262	503	115	14	3	0	0	0	0	2161	0
1995	0	181	1391	859	331	53	2	0	0	0	0	2817	0
1996	0	580	2187	554	132	56	13	1	2	1	0	3526	4
1997	0	17	625	378	18	3	0.2	0	0	0	0	1041	0
1998	18	547	694	230	28	3	0.2	0	0	0	0	1520	0
1999	1	70	504	579	152	88	6	3	0.1	0	0	1403	3
2000	0	50	398	906	345	55	18	1	2	0	0	1775	3
2001	0	79	408	556	334	63	18	5	0.2	0	0	1463	5
2002	0	79	574	1032	460	70	30	3	0.2	0	0	2248	3
2003	0	43	336	712	362	124	50	8	0.456	0	0	1635	8
2004	0	24	608	863	449	238	57	22	2	0.6	0.02	2264	25
2005	0	17	471	832	389	143	44	14	3	0.4	0.04	1913	17
2006	0	18	436	658	447	258	95	26	5	3	0.5	1947	35
2007	0	12	120	581	345	135	54	25	11	2	1	1286	39
2008	0	13	103	272	424	133	83	31	11	1.5	0.4	1072	44
2009	0	3	122	398	443	298	99	24	18	1	1	1407	44
2010	0	19	222	513	403	178	155	43	12	7	1	1553	63
2011	0	0	165	306	529	141	94	86	25	10	4	1360	125

Table 8. Mean weight (kg) at age of summer flounder landed in the North Carolina commercial trawl fishery.

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1982	0.340	0.456	0.756	1.284	1.658	2.054	2.116	2.231	2.577	0.000	0.000	0.531
1983	0.319	0.452	0.746	1.140	1.262	1.488	1.729	2.428	2.696	0.000	0.000	0.572
1984	0.331	0.475	0.704	1.059	1.504	2.167	3.482	0.000	0.000	0.000	0.000	0.585
1985	0.377	0.460	0.664	1.203	1.675	2.485	3.073	4.571	0.000	0.000	0.000	0.617
1986	0.360	0.512	0.674	1.092	1.623	1.955	3.398	3.233	3.626	0.000	0.000	0.637
1987	0.334	0.512	0.655	1.086	1.878	2.944	0.000	0.000	0.000	0.000	0.000	0.590
1988	0.000	0.411	0.598	0.926	1.189	1.702	2.241	2.982	3.412	0.000	0.000	0.565
1989	0.118	0.380	0.603	0.988	1.161	2.095	3.086	2.496	0.000	0.000	0.000	0.779
1990	0.079	0.483	0.664	0.867	1.306	2.095	1.897	3.972	0.000	0.000	0.000	0.773
1991	0.000	0.448	0.655	1.072	1.729	2.252	2.508	3.126	4.097	0.000	0.000	0.767
1992	0.000	0.363	0.504	0.851	1.198	1.457	2.302	0.000	0.000	0.000	0.000	0.713
1993	0.000	0.489	0.608	1.128	1.371	2.946	3.406	0.000	0.000	0.000	0.000	0.664
1994	0.272	0.451	0.618	1.270	2.039	2.443	2.888	5.780	0.000	0.000	0.000	0.839
1995	0.038	0.210	0.461	0.853	1.474	2.492	3.792	3.815	0.000	0.000	0.000	0.724
1996	0.000	0.420	0.470	0.730	1.350	1.720	2.290	3.200	2.710	4.510	0.000	0.565
1997	0.000	0.407	0.616	0.760	1.323	2.069	3.248	0.000	0.000	0.000	0.000	0.682
1998	0.405	0.714	0.890	1.237	1.491	2.802	3.381	0.000	0.000	0.000	0.000	0.889
1999	0.144	0.578	0.729	0.919	1.402	1.682	2.609	3.063	3.904	0.000	0.000	0.945
2000	0.000	0.558	0.656	0.801	1.201	1.963	2.590	3.307	3.521	0.000	0.000	0.898
2001	0.000	0.594	0.674	0.758	1.065	1.716	2.388	3.067	4.240	0.000	0.000	0.865
2002	0.000	0.520	0.650	0.760	0.990	1.650	2.200	3.030	4.420	0.000	0.000	0.821
2003	0.000	0.460	0.700	0.890	1.550	2.480	3.250	3.870	4.820	0.000	0.000	1.194
2004	0.000	0.510	0.640	0.820	1.120	1.410	2.140	2.990	3.780	4.020	0.000	0.948
2005	0.000	0.580	0.670	0.870	1.150	1.650	2.430	2.900	3.570	4.298	0.000	0.989
2006	0.000	0.600	0.669	0.815	1.070	1.427	1.842	2.573	3.097	3.803	0.000	1.004
2007	0.000	0.550	0.680	0.780	1.010	1.420	1.730	2.160	2.570	3.720	0.000	0.983
2008	0.000	0.596	0.667	0.834	1.015	1.375	1.551	1.916	2.947	4.856	0.000	1.068
2009	0.000	0.511	0.634	0.765	0.893	1.130	1.507	1.974	1.664	3.285	4.720	0.960
2010	0.000	0.558	0.636	0.791	0.995	1.243	1.483	1.906	2.950	4.881	4.852	1.008
2011	0.000	0.000	0.570	0.670	0.820	1.260	1.490	1.680	2.050	2.300	4.260	0.950

Table 9. Summary Northeast Region (NER) Fishery Observer sample data for trips catching summer flounder. Total trips (trips are not split for multiple areas), observed tows, total summer flounder catch observed, total summer flounder kept observed, and total summer flounder discard observed, and percentage of summer flounder discard to summer flounder catch observed. All catches in pounds. Includes NER At-Sea Monitoring (ASM) trips for 2010-2011.

Year	Gear	Trips	Tows	Total Catch	Total Kept	Total Discard	Discard: Total (%)
1989	All	57	413	53,714	48,406	5,308	9.9
1990	All	61	463	47,954	35,972	11,982	25.0
1991	All	82	635	61,650	50,410	11,240	18.2
1992	Trawl	66	643	136,632	118,026	18,606	13.6
	Scallop	8	178	1,477	767	710	48.1
	All	74	821	138,109	118,793	19,316	14.0
1993	Trawl	37	410	74,982	67,603	7,379	9.8
	Scallop	15	671	2,967	1,158	1,809	61.0
	All	52	1,081	77,949	68,761	9,188	11.8
1994	Trawl	51	574	174,347	163,734	10,612	6.1
	Scallop	14	651	5,811	435	5,376	92.5
	All	65	1,225	180,158	164,169	15,988	8.9
1995	Trawl	134	1,004	242,784	235,011	7,773	3.2
	Scallop	19	1,051	10,044	2,247	7,778	77.4
	All	153	2,055	252,828	237,258	15,551	6.2
1996	Trawl	111	653	101,389	90,789	10,600	10.5
	Scallop	24	1,083	9,575	1,345	8,230	86.0
	All	135	1,736	110,964	92,134	18,830	17.0
1997	Trawl	59	334	31,707	26,475	5,232	16.5
	Scallop	23	835	5,721	583	5,138	89.8
	All	82	1,169	37,428	27,058	10,370	27.7

Table 9, continued. Summary Northeast Region (NER) Fishery Observer sample data for trips catching summer flounder. Total trips (trips are not split for multiple areas), observed tows, total summer flounder catch observed, total summer flounder kept observed, and total summer flounder discard observed, and percentage of summer flounder discard to summer flounder catch observed. All catches in pounds. Includes NER At-Sea Monitoring (ASM) trips for 2010-2011.

Year	Gear	Trips	Tows	Total Catch	Total Kept	Total Discard	Discard: Total (%)
1998	Trawl	53	329	72,396	65,507	6,889	9.5
	Scallop	22	359	1,962	652	1,310	66.8
	All	75	688	74,358	66,159	8,199	11.0
1999	Trawl	56	374	60,733	45,987	14,746	24.3
	Scallop	10	247	3,199	458	2,741	85.7
	All	66	621	63,932	46,445	17,487	27.4
2000	Trawl	115	688	162,015	144,752	17,263	10.7
	Scallop	23	608	8,457	501	7,956	94.1
	All	138	1,296	170,472	145,253	25,219	14.8
2001	Trawl	137	605	109,910	61,625	48,295	43.9
	Scallop	68	1,606	11,622	800	10,822	93.1
	All	205	2,211	121,532	62,425	59,117	48.6
2002	Trawl	175	837	141,246	124,053	17,193	12.2
	Scallop	55	2,522	25,871	887	24,984	96.6
	All	230	3,359	167,117	124,940	42,177	25.2
2003	Trawl	212	1,316	235,685	195,371	40,314	17.1
	Scallop	79	3,248	37,021	2,378	34,643	93.6
	All	291	4,564	272,706	197,749	74,957	27.5
2004	Trawl	546	2,570	561,689	477,634	84,055	15.0
	Scallop	132	4,444	59,787	4,016	55,771	93.3
	All	678	7,014	621,476	481,650	139,826	22.5
2005	Trawl	906	5,993	800,082	580,949	219,133	27.4
	Scallop	136	3,786	38,227	2,805	35,422	92.7
	All	1,042	9,779	838,309	583,754	254,555	30.4

Table 9, continued. Summary Northeast Region (NER) Fishery Observer sample data for trips catching summer flounder. Total trips (trips are not split for multiple areas), observed tows, total summer flounder catch observed, total summer flounder kept observed, and total summer flounder discard observed, and percentage of summer flounder discard to summer flounder catch observed. All catches in pounds. Includes NER At-Sea Monitoring (ASM) trips for 2010-2011.

Year	Gear	Trips	Tows	Total Catch	Total Kept	Total Discard	Discard: Total (%)
2006	Trawl	578	4,017	566,458	309,915	256,544	45.3
	Scallop	117	1,488	15,687	1,323	14,364	91.6
	All	695	5,505	582,145	311,238	270,908	46.5
2007	Trawl	682	3,972	759,360	332,373	426,987	56.2
	Scallop	233	4,059	58,865	729	56,136	95.4
	All	915	8,031	818,225	333,102	483,123	59.0
2008	Trawl	559	2,890	482,775	288,182	194,593	40.3
	Scallop	383	8,039	91,826	3,786	88,040	95.9
	All	942	10,929	574,601	291,968	282,633	49.2
2009	Trawl	845	4,450	736,910	506,768	230,142	31.2
	Scallop	300	8,042	69,857	3,382	66,475	95.2
	All	1,145	12,492	806,767	510,150	296,617	36.8
2010	Trawl	982	4,802	1,236,762	973,384	263,378	21.3
	Scallop	221	6,817	75,859	1,788	74,072	97.6
	All	1,203	11,619	1,312,621	975,172	337,450	25.7
2011	Trawl	1,068	6,225	1,283,337	1,069,777	213,560	16.6
	Scallop	258	7,110	78,893	3,192	75,701	96.0
	All	1,326	13,335	1,362,230	1,072,969	289,261	21.2

Table 10. Summary Northeast Region (NER) Vessel Trip Report (VTR) data for trips reporting discard of any species and catching summer flounder. Total trips, total summer flounder catch, total summer flounder kept, total summer flounder discard, and percentage of summer flounder discard to summer flounder catch. All catches in pounds.

Year	Gear	Trips	Total Catch	Total Kept	Total Discard	Discard: Total (%)
1994	Trawl	4,267	2,149,332	2,015,296	134,036	6.2
	Scallop	85	70,353	22,877	47,476	67.5
	All	4,352	2,219,685	2,038,173	181,512	8.2
1995	Trawl	3,733	2,444,231	2,332,516	111,715	4.6
	Scallop	113	78,758	25,084	53,674	68.2
	All	3,846	2,522,989	2,357,600	165,389	6.6
1996	Trawl	2,990	1,662,313	1,459,155	203,158	12.2
	Scallop	79	69,557	16,657	52,900	76.1
	All	3,069	1,731,870	1,475,812	256,058	14.8
1997	Trawl	3,044	988,599	851,090	137,509	13.9
	Scallop	51	21,553	4,665	16,888	78.4
	All	3,095	1,010,152	855,755	154,397	15.3
1998	Trawl	3,004	1,128,578	868,706	259,872	23.0
	Scallop	62	23,538	10,323	13,215	56.1
	All	3,066	1,152,116	879,029	273,087	23.7
1999	Trawl	2,884	959,275	772,924	186,351	19.4
	Scallop	41	26,334	14,324	12,010	45.6
	All	2,925	985,609	787,248	198,361	20.1
2000	Trawl	3,140	1,048,791	786,576	262,215	25.0
	Scallop	41	12,183	3,798	8,385	68.8
	All	3,181	1,060,974	790,374	270,600	25.5
2001	Trawl	3,035	1,091,056	783,900	307,156	28.2
	Scallop	71	14,662	1,349	13,313	90.8
	All	3,106	1,105,718	785,249	320,469	29.0

Table 10, continued. Summary Northeast (NER) Vessel Trip Report (VTR) data for trips reporting discard of any species and catching summer flounder. Total trips, total summer flounder catch, total summer flounder kept, total summer flounder discard, and percentage of summer flounder discard to summer flounder catch. All catches in pounds.

Year	Gear	Trips	Total Catch	Total Kept	Total Discard	Discard: Total (%)
2002	Trawl	3,549	1,164,038	924,590	239,448	20.6
	Scallop	107	23,879	6,913	16,966	71.1
	All	3,656	1,187,917	931,503	256,414	21.6
2003	Trawl	3,008	1,484,076	877,458	606,618	40.9
	Scallop	72	21,190	6,028	15,162	71.6
	All	3,080	1,505,266	883,486	621,780	41.3
2004	Trawl	3,607	1,866,542	1,511,013	355,529	19.0
	Scallop	69	24,814	9,478	15,336	61.8
	All	3,676	1,891,356	1,520,491	370,865	19.6
2005	Trawl	2,475	1,870,302	1,542,640	327,662	17.5
	Scallop	55	11,405	5,364	6,041	53.0
	All	2,530	1,881,707	1,548,004	333,703	17.7
2006	Trawl	2,575	1,373,070	974,264	398,806	29.0
	Scallop	144	17,613	3,091	14,522	82.5
	All	2,719	1,390,683	977,355	413,328	29.7
2007	Trawl	2,633	1,253,778	822,298	431,480	34.4
	Scallop	167	32,937	12,379	20,558	62.4
	All	2,800	1,286,715	834,677	452,038	35.1
2008	Trawl	2,164	1,065,118	807,501	257,617	24.2
	Scallop	109	44,992	11,362	33,630	74.7
	All	2,273	1,110,110	818,863	291,247	26.2
2009	Trawl	2,036	1,051,784	846,685	205,099	19.5
	Scallop	85	19,836	4,166	15,670	79.0
	All	2,121	1,071,620	850,851	220,769	20.6
2010	Trawl	2,230	1,372,669	1,159,710	213,302	15.5
	Scallop	85	18,722	6,306	13,692	73.1
	All	2,315	1,391,391	1,166,016	226,994	16.3
2011	Trawl	2,323	1,866,017	1,744,319	121,778	6.5
	Scallop	67	11,078	2,269	8,904	80.4
	All	2,390	1,877,095	1,746,588	130,682	7.0

Table 11. Summary of Northeast Region (NER) Fishery Observer data to estimate summer flounder discard at age in the commercial fishery. Estimates developed using fishery observer length samples, age-length data, and estimates of total discard in metric tons (mt). An 80% discard mortality rate is assumed. Lengths converted to age using NEFSC survey age-length keys; includes NER At-Sea Monitoring (ASM) data for 2010-2011; n/a = not available.

Year	Gear	Lengths	Ages	Fishery Observer Discard Estimate (mt)	Sampling Intensity (mt per 100 lengths)	Raised Discard Estimate (mt)	Raised Estimate with 80% mortality rate (mt)
1989	All	2,337	54	642	27	886	709
1990	All	3,891	453	1,121	29	1,517	1,214
1991	All	5,326	190	993	19	1,315	1,052
1992	All	9,626	331	755	8	862	690
1993	All	3,410	406	817	24	1,057	846
1994	Trawl	2,338	---	429	18	542	434
	Scallop	660	---	590	89	590	472
	All	2,998	354	1,019	34	1,132	906
1995	Trawl	1,822	---	130	7	173	138
	Scallop	731	---	212	29	212	170
	All	2,553	n/a	342	13	385	308
1996	Trawl	1,873	---	319	17	444	355
	Scallop	854	---	135	16	135	108
	All	2,727	n/a	454	17	579	463
1997	Trawl	839		299	36	299	239
	Scallop	556		108	19	108	86
	All	1,395	n/a	407	29	407	326

Table 11, continued. Summary of Northeast (NER) Fishery Observer data to estimate summer flounder discard at age in the commercial fishery. Estimates developed using fishery observer length samples, age-length data, and estimates of total discard in metric tons (mt). An 80% discard mortality rate is assumed. Lengths converted to age using Northeast Fisheries Science Center survey age-length keys; includes NER At-Sea Monitoring (ASM) data for 2010-2011; n/a = not available.

Year	Gear	Lengths	Ages	Fishery Observer Discard Estimate (mt)	Sampling Intensity (mt per 100 lengths)	Raised Discard Estimate (mt)	Raised Estimate with 80% mortality rate (mt)
1998	Trawl	721		318	44	318	254
	Scallop	150		169	113	169	135
	All	871	n/a	487	56	487	389
1999	Trawl	1,145		1,476	129	1,476	1,181
	Scallop	216		459	213	459	367
	All	1,361	n/a	1,935	142	1,935	1,548
2000	Trawl	1,470		740	50	740	592
	Scallop	2,611		167	6	167	134
	All	4,081	n/a	907	22	907	726
2001	Trawl	1,528		287	19	287	230
	Scallop	705		297	42	297	238
	All	2,233	n/a	584	26	584	468
2002	Trawl	3,438		384	11	384	307
	Scallop	2,952		178	6	178	142
	All	6,390	n/a	562	9	562	449
2003	Trawl	4,233		556	13	556	445
	Scallop	2,594		104	4	104	83
	All	6,827	n/a	660	10	660	528
2004	Trawl	5,760		213	4	213	170
	Scallop	8,811		92	1	92	74
	All	14,571	n/a	305	2	305	244
2005	Trawl	9,562		191	2	191	153
	Scallop	4,690		96	2	96	77
	All	14,252	n/a	287	2	287	230

Table 11, continued. Summary of Northeast (NER) Fishery Observer data to estimate summer flounder discard at age in the commercial fishery. Estimates developed using fishery observer length samples, age-length data, and estimates of total discard in metric tons (mt). An 80% discard mortality rate is assumed. Lengths converted to age using Northeast Fisheries Science Center survey age-length keys; includes NER At-Sea Monitoring (ASM) data for 2010-2011; n/a = not available.

Year	Gear	Lengths	Ages	Fishery Observer Discard Estimate (mt)	Sampling Intensity (mt per 100 lengths)	Raised Discard Estimate (mt)	Raised Estimate with 80% mortality rate (mt)
2006	Trawl	8,283		268	3	268	214
	Scallop	1,911		93	5	93	74
	All	10,194	n/a	361	4	361	288
2007	Trawl	12,725		275	2	275	220
	Scallop	4,972		105	2	105	84
	All	17,697	n/a	380	2	380	304
2008	Trawl	6,815		279	4	279	223
	Scallop	8,211		107	1	107	86
	All	15,026	n/a	386	2	386	309
2009	Trawl	9,441		135	1	135	108
	Scallop	8,970		13	1	13	10
	All	18,411	n/a	148	1	148	118
2010	Trawl	8,460		214	1	214	171
	Scallop	7,826		34	1	34	27
	All	16,286	n/a	248	1	248	198
2011	Trawl	8,710		124	1	124	99
	Scallop	6,785		34	1	34	27
	All	15,495	n/a	158	1	158	126

Table 12. Comparison of commercial fishery dealer reported landings (metric tons; mt) of summer flounder with estimates of summer flounder commercial landings from landings rates of Northest Region (NER) Fishery Observer sampling and commercial fishing effort (days fished) reported on commercial Vessel Trip Reports (VTR). Dealer and Landings estimates prior to 1997 do not reflect North Carolina landings and effort.

Year	VTR Days Fished (>000)	Observed Landings Estimate (mt)	Dealer landings Estimate (mt)	Percent Difference (Obs-Dealer)
1989	19,805	7,255	5,817	25
1990	15,980	2,959	2,749	8
1991	26,096	4,123	4,355	-5
1992	18,148	5,343	6,066	-12
1993	19,947	4,032	3,995	1
1994	18,402	6,004	4,968	21
1995	14,168	5,891	4,911	20
1996	10,351	5,024	3,718	35
1997	10,975	2,663	3,994	-33
1998	15,267	3,677	5,076	-28
1999	20,670	7,396	4,820	53
2000	11,268	6,702	5,085	32
2001	11,421	1,509	4,970	-70
2002	12,268	6,609	6,573	1
2003	13,415	5,786	6,450	-10
2004	9,288	4,997	8,228	-39
2005	13,215	3,478	7,826	-56
2006	11,856	1,794	6,262	-71
2007	8,872	1,012	4,431	-77
2008	7,615	1,445	4,143	-65
2009	7,294	1,277	4,848	-74
2010	6,639	2,605	5,930	-56
2011	6,965	1,466	7,511	-81

Table 13. Estimated summer flounder discard at age in the in the commercial fishery. Lengths converted to age using annual Northeast Fisheries Science Center trawl survey age-length keys. Includes an assumed 80% discard mortality rate. Includes NEFSC At-Sea Monitoring data for 2010-2011.

Discard numbers at age ('000)						
Year	Gear	0	1	2	3+	Total
1989	All	775	1,628	94	0	2,497
1990	All	1,441	2,755	67	0	4,263
1991	All	891	3,424	<1	0	4,315
1992	All	1,155	1,544	36	3	2,738
1993	All	1,041	1,532	179	1	2,753
1994	Trawl	571	1,014	95	0	1,680
	Scallop	0	663	398	36	1,097
	All	571	1,677	493	36	2,777
1995	Trawl	141	294	58	2	495
	Scallop	0	114	148	20	282
	All	141	408	206	22	777
1996	Trawl	23	417	167	56	663
	Scallop	<1	221	72	5	298
	All	23	638	239	61	961
1997	Trawl	8	215	203	50	476
	Scallop	0	34	98	22	154
	All	8	249	301	72	630
1998	Trawl	26	132	146	95	399
	Scallop	1	42	73	52	168
	All	27	174	219	157	567
1999	Trawl	95	1,159	1,012	255	2,521
	Scallop	1	64	239	176	480
	All	96	1,223	1,251	431	3,001
2000	Trawl	20	118	378	303	819
	Scallop	2	46	82	49	179
	All	22	164	460	352	998
2001	Trawl	11	86	56	128	281
	Scallop	0	13	50	142	205
	All	11	99	106	270	486
2002	Trawl	12	94	137	106	349
	Scallop	1	30	83	63	177
	All	13	124	220	169	526

Table 13, continued. Estimated summer flounder discard at age in the in the commercial fishery. Lengths converted to age using annual Northeast Fisheries Science Center (NEFSC) trawl survey age-length keys. Includes an assumed 80% discard mortality rate. Includes NEFSC At-Sea Monitoring data for 2010-2011.

Discard numbers at age ('000)

Year	Gear	0	1	2	3+	Total
2003	Trawl	2	221	208	84	515
	Scallop	0	43	48	20	111
	All	2	264	256	104	626
2004	Trawl	1	25	70	70	166
	Scallop	<1	14	64	27	105
	All	2	39	134	98	271
2005	Trawl	4	33	44	65	146
	Scallop	<1	8	52	40	100
	All	4	41	96	105	246
2006	Trawl	4	38	102	82	226
	Scallop	<1	11	79	34	124
	All	4	49	181	115	350
2007	Trawl	9	26	29	108	172
	Scallop	<1	3	51	55	109
	All	9	29	80	163	281
2008	Trawl	3	46	37	113	199
	Scallop	<1	7	16	71	95
	All	2	53	53	184	294
2009	Trawl	2	15	42	53	112
	Scallop	0	1	4	9	13
	All	2	16	46	61	125
2010	Trawl	13	58	78	100	249
	Scallop	1	5	8	20	34
	All	14	63	86	120	283
2011	Trawl	3	19	62	71	155
	Scallop	<1	3	13	24	40
	All	3	23	74	95	196

Table 14. Estimated summer flounder discard mean length at age in the commercial fishery. Lengths converted to age using Northeast Fisheries Science Center (NEFSC) trawl survey age-length keys.

		Discard mean length (cm) at age				
Year	Gear	0	1	2	3+	All
1989	All	25.9	31.5	44.2		30.2
1990	All	29.0	31.7	38.9		30.9
1991	All	24.0	30.9	37.0		29.5
1992	All	29.3	30.0	36.6	51.2	29.8
1993	All	30.0	32.5	34.8	55.0	31.7
1994	Trawl	26.0	31.3	34.5		29.7
	Scallop		30.8	38.2	52.1	34.2
	All	26.0	31.1	37.5	52.1	31.5
1995	Trawl	29.6	29.4	37.0	50.9	30.4
	Scallop		30.7	40.6	52.4	37.4
	All	29.6	29.8	39.6	52.5	33.0
1996	Trawl	28.9	32.0	38.1	55.8	35.5
	Scallop	31.4	30.7	38.2	48.5	32.8
	All	29.0	31.6	38.1	55.2	34.7
1997	Trawl	26.9	32.1	37.8	46.6	36.0
	Scallop		32.5	37.2	45.9	37.5
	All	26.9	32.2	37.6	46.3	36.4
1998	Trawl	26.0	32.5	37.5	48.3	37.7
	Scallop	30.0	35.0	39.7	48.9	41.3
	All	26.1	33.1	38.2	48.5	38.8
1999	Trawl	25.8	32.0	35.9	48.5	34.9
	Scallop	31.0	33.2	36.3	48.8	40.5
	All	25.9	32.1	36.0	48.6	35.9
2000	Trawl	17.2	32.6	37.7	46.3	39.5
	Scallop	26.8	34.4	39.5	47.6	40.3
	All	18.1	33.2	38.0	46.5	39.6
2001	Trawl	22.9	33.7	39.6	47.7	40.8
	Scallop		37.1	40.6	49.1	46.3
	All	22.9	34.2	40.1	48.5	43.1
2002	Trawl	27.7	32.4	37.6	53.6	40.7
	Scallop	27.7	35.1	39.1	48.1	41.5
	All	27.7	33.1	38.1	51.6	41.0

Table 14, continued. Estimated summer flounder discard mean length at age in the commercial fishery. Lengths converted to age using Northeast Fisheries Science Center (NEFSC) trawl survey age-length keys.

		Discard mean length (cm) at age				
Year	Gear	0	1	2	3+	All
2003	Trawl	27.4	33.6	38.3	54.4	38.9
	Scallop		34.6	40.1	50.1	39.7
	All	27.4	33.8	38.6	53.6	39.0
2004	Trawl	28.4	33.6	38.8	51.8	43.4
	Scallop	29.1	32.9	37.9	47.4	39.7
	All	28.5	33.3	38.4	50.6	42.0
2005	Trawl	28.4	33.3	38.7	52.3	43.3
	Scallop	30.7	31.2	37.2	46.9	40.6
	All	28.4	32.9	37.9	50.3	42.2
2006	Trawl	25.8	33.9	37.6	50.5	41.4
	Scallop	25.0	33.9	36.2	43.9	38.1
	All	25.8	33.9	37.0	48.6	40.3
2007	Trawl	26.1	32.8	41.1	51.4	45.5
	Scallop	24.3	31.6	38.2	44.5	41.2
	All	26.1	32.7	39.3	49.0	43.8
2008	Trawl	25.2	30.0	36.0	52.3	43.7
	Scallop	27.1	32.9	38.2	50.2	46.8
	All	25.4	30.4	36.7	51.5	44.7
2009	Trawl	26.1	31.2	35.7	49.4	41.1
	Scallop		29.7	36.4	47.2	42.7
	All	26.1	31.1	35.8	49.1	41.6
2010	Trawl	27.5	31.7	35.4	45.6	38.2
	Scallop	27.0	32.2	36.8	45.0	40.7
	All	27.5	31.7	35.5	45.5	38.5
2011	Trawl	27.4	31.8	34.4	43.3	38.0
	Scallop	29.6	30.7	34.9	42.2	38.9
	All	27.4	31.6	34.5	43.0	38.2

Table 15. Estimated summer flounder discard mean weight at age in the in the commercial fishery. Lengths converted to age using Northeast Fisheries Science Center (NEFSC) trawl survey age-length keys.

Discard mean weight (kg) at age						
Year	Gear	0	1	2	3+	All
1989	All	0.182	0.296	0.909		0.284
1990	All	0.235	0.304	0.559		0.285
1991	All	0.124	0.275	0.491		0.244
1992	All	0.238	0.256	0.498	1.450	0.252
1993	All	0.253	0.332	0.413		0.307
1994	Trawl	0.177	0.291	0.392		0.258
	Scallop		0.287	0.565	1.565	0.430
	All	0.177	0.289	0.532	1.565	0.326
1995	Trawl	0.244	0.242	0.522	1.505	0.280
	Scallop		0.281	0.702	1.604	0.595
	All	0.244	0.253	0.651	1.597	0.395
1996	Trawl	0.226	0.312	0.586	2.004	0.521
	Scallop	0.305	0.274	0.572	1.254	0.363
	All	0.227	0.299	0.582	1.937	0.472
1997	Trawl	0.178	0.327	0.560	1.088	0.504
	Scallop		0.331	0.553	1.044	0.558
	All	0.178	0.328	0.558	1.075	0.517
1998	Trawl	0.158	0.332	0.533	1.346	0.637
	Scallop	0.247	0.421	0.651	1.357	0.808
	All	0.161	0.353	0.572	1.350	0.688
1999	Trawl	0.156	0.317	0.462	1.300	0.468
	Scallop	0.275	0.355	0.478	1.310	0.767
	All	0.157	0.319	0.465	1.304	0.516
2000	Trawl	0.055	0.355	0.555	1.114	0.722
	Scallop	0.174	0.412	0.643	1.023	0.741
	All	0.066	0.371	0.571	1.138	0.725
2001	Trawl	0.114	0.373	0.642	1.210	0.797
	Scallop		0.510	0.692	1.339	1.127
	All	0.114	0.391	0.665	1.278	0.936
2002	Trawl	0.194	0.331	0.538	1.851	0.871
	Scallop	0.195	0.429	0.608	1.235	0.795
	All	0.194	0.355	0.565	1.623	0.845

Table 15, continued. Estimated summer flounder discard mean weight at age in the in the commercial fishery. Lengths converted to age using Northeast Fisheries Science Center (NEFSC) trawl survey age-length keys.

Discard mean weight (kg) at age						
Year	Gear	0	1	2	3+	All
2003	Trawl	0.186	0.371	0.583	1.871	0.701
	Scallop		0.413	0.672	1.430	0.705
	All	0.186	0.378	0.600	1.788	0.701
2004	Trawl	0.220	0.386	0.599	1.625	0.996
	Scallop	0.223	0.352	0.554	1.234	0.698
	All	0.220	0.374	0.578	1.508	0.880
2005	Trawl	0.214	0.366	0.597	1.669	1.015
	Scallop	0.268	0.290	0.520	1.162	0.752
	All	0.214	0.351	0.555	1.480	0.908
2006	Trawl	0.157	0.382	0.547	1.505	0.860
	Scallop	0.137	0.374	0.468	0.976	0.597
	All	0.157	0.380	0.513	1.352	0.767
2007	Trawl	0.161	0.338	0.717	1.548	1.152
	Scallop	0.133	0.302	0.558	0.962	0.755
	All	0.161	0.334	0.616	1.349	0.998
2008	Trawl	0.147	0.269	0.462	1.687	1.109
	Scallop	0.179	0.353	0.566	1.481	1.233
	All	0.151	0.281	0.493	1.608	1.149
2009	Trawl	0.164	0.297	0.445	1.452	0.896
	Scallop		0.250	0.480	1.211	0.922
	All	0.164	0.295	0.448	1.420	0.898
2010	Trawl	0.194	0.304	0.429	1.150	0.677
	Scallop	0.182	0.325	0.490	1.028	0.776
	All	0.193	0.306	0.435	1.129	0.689
2011	Trawl	0.194	0.311	0.393	1.000	0.657
	Scallop	0.245	0.281	0.417	0.839	0.659
	All	0.195	0.307	0.397	0.959	0.658

Table 16. Estimated total landings (catch types A + B1, [000s]) of summer flounder by recreational fishermen as estimated by the Marine Recreational Fisheries Statistics Survey (MRFSS). SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate.

	YEAR										
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
North											
Shore	167	144	62	10	70	39	42	4	16	9	26
P/C Boat	138	201	5	3	48	7	1	1	1	8	1
P/R Boat	1,293	747	568	382	2,562	648	377	137	99	173	211
TOTAL	1,598	1,092	635	395	2,680	694	420	142	116	190	238
Mid											
Shore	682	3,296	977	272	478	251	596	84	96	505	200
P/C Boat	5,745	3,321	2,381	1,068	1,541	1,143	1,134	141	412	589	374
P/R Boat	5,731	12,345	11,764	8,454	5,924	5,499	7,153	1,141	2,658	4,573	3,983
TOTAL	12,158	18,962	15,122	9,794	7,943	6,893	8,883	1,366	3,166	5,667	4,557
South											
Shore	272	523	316	504	689	115	308	91	150	51	50
P/C Boat	53	52	110	81	20	1	1	1	1	1	1
P/R Boat	1,392	367	1,292	292	289	162	348	117	361	159	156
TOTAL	1,717	942	1,718	877	998	278	657	209	512	211	207
All											
Shore	1,121	3,963	1,355	786	1,237	405	946	179	262	565	276
P/C Boat	5,936	3,574	2,496	1,152	1,609	1,151	1,136	143	414	598	376
P/R Boat	8,416	13,459	13,624	9,128	8,775	6,309	7,878	1,395	3,118	4,905	4,350
TOTAL	15,473	20,996	17,475	11,066	11,621	7,865	9,960	1,717	3,794	6,068	5,002
PSE (%)	26	7	8	12	7	5	4	6	4	4	4

Table 16, continued. Estimated total landings (catch types A + B1, [000s]) of summer flounder by recreational fishermen as estimated by the Marine Recreational Fisheries Statistics Survey (MRFSS). SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate.

	YEAR										
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
North											
Shore	37	47	19	22	27	44	34	61	5	18	26
P/C Boat	14	25	7	5	22	26	19	49	14	21	36
P/R Boat	298	584	388	702	669	970	769	1,448	555	401	487
TOTAL	349	656	414	729	718	1,040	822	1,558	574	440	549
Mid											
Shore	186	217	173	134	195	243	157	467	199	123	145
P/C Boat	999	809	260	650	907	333	281	600	316	238	353
P/R Boat	4,579	4,633	2,330	5,137	5,059	4,972	2,610	4,802	3,878	2,272	3,424
TOTAL	5,764	5,659	2,763	5,921	6,161	5,548	3,048	5,869	4,393	2,633	3,922
South											
Shore	118	183	49	50	33	30	22	41	22	14	32
P/C Boat	1	3	1	5	2	1	<1	1	<1	3	<1
P/R Boat	262	202	99	292	253	360	214	332	304	172	55
TOTAL	381	388	149	347	288	391	237	374	327	189	88
All Regions											
Shore	341	447	241	206	255	317	213	569	226	155	203
P/C Boat	1,014	837	268	660	931	360	301	650	331	262	390
P/R Boat	5,139	5,419	2,817	6,131	5,981	6,302	3,593	6,582	4,737	2,845	3,966
TOTAL	6,494	6,703	3,326	6,997	7,167	6,979	4,107	7,801	5,294	3,262	4,559
PSE (%)	4	4	4	3	4	4	4	3	4	4	4

Table 16, continued. Estimated total landings (catch types A + B1, [000s]) of summer flounder by recreational fishermen as estimated by the Marine Recreational Fisheries Statistics Survey (MRFSS). SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate.

	YEAR							
	2004	2005	2006	2007	2008	2009	2010	2011
North								
Shore	21	22	12	2	0	5	2	2
P/C Boat	25	32	41	55	33	12	19	29
P/R Boat	740	550	539	360	440	144	148	229
TOTAL	786	605	591	417	473	161	169	248
Mid								
Shore	143	109	90	146	51	52	36	36
P/C Boat	467	443	338	327	103	179	103	97
P/R Boat	2,988	2,751	2,965	2,319	1,614	1,460	1,085	1,335
TOTAL	3,598	3,303	3,393	2,792	1,768	1,691	1,224	1,468
South								
Shore	46	15	26	14	19	12	22	13
P/C Boat	3	2	2	20	1	1	<1	2
P/R Boat	124	112	125	151	34	45	69	51
TOTAL	173	129	153	185	54	58	91	66
All								
Shore	210	146	128	161	70	69	60	50
P/C Boat	495	477	381	402	137	192	123	117
P/R Boat	3,852	3,413	3,629	2,830	2,088	1,649	1,302	1,614
TOTAL	4,557	4,036	4,138	3,394	2,295	1,910	1,484	1,782
PSE (%)	4	5	5	4	5	5	7	9

Table 17. Estimated total landings (catch types A + B1, [mt]) of summer flounder by recreational fishermen as estimated by the Marine Recreational Fisheries Statistics Survey (MRFSS). SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate.

	YEAR										
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
North											
Shore	87	59	17	7	25	21	32	2	16	6	20
P/C Boat	85	87	4	2	45	4	<1	<1	<1	6	<1
P/R Boat	875	454	388	328	2,597	582	290	141	89	150	175
TOTAL	1,047	600	409	337	2,667	607	323	144	106	162	196
Mid											
Shore	295	1,254	399	140	293	129	330	52	56	306	126
P/C Boat	3,112	2,196	1,426	609	1,093	1,098	776	125	264	364	267
P/R Boat	3,085	8,389	5,686	4,187	3,521	3,596	4,928	985	1,665	2,673	2,536
TOTAL	6,492	11,839	7,511	4,936	4,907	4,823	6,034	1,162	1,985	3,343	2,929
South											
Shore	87	134	98	230	425	34	113	57	76	25	25
P/C Boat	12	12	23	20	7	1	<1	<1	<1	<1	<1
P/R Boat	629	102	471	142	96	54	163	71	161	80	91
TOTAL	728	248	592	392	528	89	277	129	238	106	117
All											
Shore	469	1,447	514	377	743	184	475	111	148	337	171
P/C Boat	3,209	2,295	1,453	631	1,145	1,103	778	127	266	371	269
P/R Boat	4,589	8,945	6,545	4,657	6,214	4,232	5,381	1,197	1,915	2,903	2,802
TOTAL	8,267	12,687	8,512	5,665	8,102	5,519	6,634	1,435	2,329	3,611	3,242
PSE (%)	25	7	8	11	9	9	4	6	4	4	4

Table 17, continued. Estimated total landings (catch types A + B1, [mt]) of summer flounder by recreational fishermen as estimated by the Marine Recreational Fisheries Statistics Survey (MRFSS). SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate.

	YEAR										
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
North											
Shore	26	29	14	15	17	56	27	73	6	20	32
P/C Boat	10	14	6	8	17	22	18	43	16	30	35
P/R Boat	214	401	320	518	445	833	738	1,536	695	559	540
TOTAL	250	444	340	541	479	911	783	1,652	717	609	607
Mid											
Shore	94	122	108	78	127	160	136	363	187	135	148
P/C Boat	617	499	179	414	712	274	286	649	349	274	457
P/R Boat	2,833	2,958	1,721	3,246	3,898	4,096	2,461	4,596	3,842	2,517	4,009
TOTAL	3,544	3,579	2,008	3,738	4,737	4,530	2,883	5,608	4,378	2,926	4,614
South											
Shore	61	102	30	26	18	18	13	24	15	9	22
P/C Boat	<1	1	<1	2	1	1	<1	<1	<1	1	<1
P/R Boat	150	105	80	147	147	199	115	185	168	88	35
TOTAL	212	208	111	175	166	218	129	210	184	98	58
All											
Shore	181	253	152	119	162	234	176	460	208	164	202
P/C Boat	628	514	186	424	730	297	305	693	366	305	493
P/R Boat	3,197	3,464	2,121	3,911	4,490	5,128	3,314	6,317	4,705	3,164	4,584
TOTAL	4,006	4,231	2,459	4,454	5,382	5,659	3,795	7,470	5,279	3,632	5,279
PSE (%)	4	4	5	3	4	5	5	4	4	4	4

Table 17, continued. Estimated total landings (catch types A + B1, [mt]) of summer flounder by recreational fishermen as estimated by the Marine Recreational Fisheries Statistics Survey (MRFSS). SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate.

	YEAR							
	2004	2005	2006	2007	2008	2009	2010	2011
North								
Shore	23	13	11	2	0	8	3	2
P/C Boat	18	42	52	75	56	23	33	29
P/R Boat	962	677	816	504	698	271	248	346
TOTAL	1,003	733	879	581	754	302	284	378
Mid								
Shore	147	100	81	136	74	60	47	45
P/C Boat	297	563	417	430	166	270	149	139
P/R Boat	3,374	3,321	3,766	3,193	2,553	2,184	1,696	1,931
TOTAL	3,818	3,984	4,265	3,760	2,793	2,514	1,892	2,114
South								
Shore	30	11	17	9	12	8	14	9
P/C Boat	4	1	2	16	<1	1	1	2
P/R Boat	78	70	76	106	24	31	47	39
TOTAL	111	82	94	131	37	40	62	49
All								
Shore	200	124	109	147	86	76	64	56
P/C Boat	318	606	472	521	223	294	183	170
P/R Boat	4,413	4,069	4,658	3,803	3,275	2,486	1,991	2,317
TOTAL	4,931	4,799	5,239	4,471	3,584	2,856	2,238	2,543
PSE (%)	4	5	5	5	5	5	5	9

Table 18. Comparison of Vessel Trip Report (VTR) reported landings of summer flounder by Party (VTRPB) and charter (VTRCB) boats, with landings estimated by the Marine Recreational Fishery Statistics Survey(MRFSS) for the Party/Charter boat (P/C Boat) sector. Data are numeric landings in thousands of fish.

Year	VTRPB	VTRCB	VTR P/C Boat Total	MRFSS P/C Boat Total	Ratio MRFSS to VTR
1995	189	44	233	268	1.15
1996	289	58	347	660	1.90
1997	302	68	370	931	2.52
1998	281	73	354	360	1.02
1999	190	50	240	301	1.25
2000	208	75	283	650	2.30
2001	105	42	147	331	2.25
2002	104	40	144	262	1.82
2003	123	44	167	390	2.35
2004	101	32	133	495	3.71
2005	80	21	101	552	5.47
2006	42	20	62	296	4.77
2007	64	28	92	402	4.37
2008	40	13	53	137	2.34
2009	32	12	44	192	4.36
2010	32	16	48	123	2.56
2011	62	14	76	117	1.54

Table 19. Recreational fishery sampling intensity for summer flounder by Marine Recreational Fisheries Statistics Survey (MRFSS) Subregion. Includes both MRFSS and state agency lengths.

Year	Subregion	Landings (A+B1; mt)	Number Measured	mt/100 Lengths
1982	North	1,047	231	453
	Mid	6,492	2,896	224
	South	728	576	126
	TOTAL	8,267	3,703	223
1983	North	600	311	192
	Mid	11,839	4,712	251
	South	248	170	146
	TOTAL	12,687	5,193	244
1984	North	409	168	243
	Mid	7,511	2,195	342
	South	592	283	209
	TOTAL	8,512	2,646	322
1985	North	337	78	432
	Mid	4,936	1,934	255
	South	392	274	143
	TOTAL	5,665	2,286	248
1986	North	2,667	266	1,003
	Mid	4,907	1,808	271
	South	528	288	183
	TOTAL	8,102	2,362	343
1987	North	607	217	280
	Mid	4,823	1,897	254
	South	89	445	20
	TOTAL	5,519	2,559	216
1988	North	323	310	104
	Mid	6,034	2,865	214
	South	277	743	38
	TOTAL	6,634	3,918	172
1989	North	144	107	135
	Mid	1,162	1,582	73
	South	129	358	36
	TOTAL	1,435	2,047	70

Table 19, continued. Recreational fishery sampling intensity for summer flounder by Marine Recreational Fisheries Statistics Survey (MRFSS) Subregion. Includes both MRFSS and state agency lengths.

Year	Subregion	Landings (A+B1; mt)	Number Measured	mt/100 Lengths
1990	North	106	110	96
	Mid	1,985	2,667	74
	South	238	1,293	18
	TOTAL	2,329	4,070	57
1991	North	162	189	86
	Mid	3,343	4,648	72
	South	106	820	13
	TOTAL	3,611	5,657	64
1992	North	196	425	46
	Mid	2,929	4,504	65
	South	117	566	21
	TOTAL	3,242	5,495	59
1993	North	250	338	63
	Mid	3,544	4,174	74
	South	212	995	20
	TOTAL	4,006	5,507	63
1994	North	444	621	75
	Mid	3,579	3,834	90
	South	208	1,467	14
	TOTAL	4,231	5,922	69
1995	North	340	501	68
	Mid	2,008	1,470	137
	South	111	485	23
	TOTAL	2,459	2,456	100
1996	North	541	919	59
	Mid	3,738	3,373	111
	South	175	1,188	15
	TOTAL	4,454	5,480	81
1997	North	480	786	61
	Mid	4,736	2,988	159
	South	166	1,026	16
	TOTAL	5,382	4,800	112

Table 19, continued. Recreational fishery sampling intensity for summer flounder by Marine Recreational Fisheries Statistics Survey (MRFSS) Subregion. Includes both MRFSS and state agency lengths.

Year	Subregion	Landings (A+B1; mt)	Number Measured	mt/100 Lengths
1998	North	911	857	106
	Mid	4,530	3,205	141
	South	218	1,259	17
	TOTAL	5,659	5,321	106
1999	North	783	442	177
	Mid	2,883	1,584	182
	South	129	564	23
	TOTAL	3,795	2,590	147
2000	North	1,652	707	234
	Mid	5,608	1,892	296
	South	210	722	29
	TOTAL	7,470	3,321	225
2001	North	717	351	204
	Mid	4,378	2,963	148
	South	184	933	20
	TOTAL	5,279	4,247	124
2002	North	609	366	166
	Mid	2,925	2,695	109
	South	98	596	16
	TOTAL	3,632	3,657	99
2003	North	607	514	118
	Mid	4,614	3,003	154
	South	58	139	42
	TOTAL	5,279	3,656	144
2004	North	1,003	1,548	65
	Mid	3,818	2,486	154
	South	110	276	40
	TOTAL	4,931	4,310	114
2005	North	717	551	130
	Mid	3,926	1,994	197
	South	81	269	30
	TOTAL	4,724	2,814	168

Table 19, continued. Recreational fishery sampling intensity for summer flounder by Marine Recreational Fisheries Statistics Survey (MRFSS) Subregion. Includes both MRFSS and state agency lengths.

Year	Subregion	Landings (A+B1; mt)	Number Measured	mt/100 Lengths
2006	North	843	987	85
	Mid	4,055	1,423	285
	South	94	281	33
	TOTAL	4,992	2,691	186
2007	North	581	1,209	48
	Mid	3,733	1,863	200
	South	131	291	45
	TOTAL	4,445	3,363	132
2008	North	754	906	83
	Mid	2,793	1,022	273
	South	37	65	57
	TOTAL	3,584	1,993	180
2009	North	303	260	117
	Mid	2,514	1,939	130
	South	39	132	30
	TOTAL	2,856	2,331	123
2010	North	284	352	81
	Mid	1,892	1,188	159
	South	62	206	30
	TOTAL	2,238	1,746	128
2011	North	378	252	150
	Mid	2,115	1,759	120
	South	49	191	26
	TOTAL	2,543	2,202	115

Table 20. Estimated recreational landings at age of summer flounder (000s; catch type A + B1).

Year	0	1	2	3	4	5	6	7	8	9	10	Total	7+ N
1982	2,750	8,445	3,498	561	215	1	3	0	0	0	0	15,473	0
1983	2,302	11,612	4,978	1,340	528	220	0	16	0	0	0	20,996	16
1984	2,282	9,198	4,831	1,012	147	4	1	0	0	0	0	17,475	0
1985	1,002	5,002	4,382	473	148	59	0	0	0	0	0	11,066	0
1986	1,170	6,405	2,785	1,089	129	15	28	0	0	0	0	11,621	0
1987	467	4,676	2,085	449	182	1	5	0	0	0	0	7,865	0
1988	429	5,742	3,311	387	88	3	0	0	0	0	0	9,960	0
1989	74	539	946	135	16	2	5	0	0	0	0	1,717	0
1990	353	2,770	529	118	23	1	0	0	0	0	0	3,794	0
1991	86	3,611	2,251	79	40	1	0	0	0	0	0	6,068	0
1992	82	3,183	1,620	90	1	26	0	0	0	0	0	5,002	0
1993	79	3,930	2,323	159	1	2	0	0	0	0	0	6,494	0
1994	790	3,998	1,698	184	28	1	4	0	0	0	0	6,703	0
1995	231	1,510	1,426	116	26	16	1	0	0	0	0	3,326	0
1996	116	2,935	3,468	354	123	1	0	0	0	0	0	6,997	0
1997	4	1,148	4,188	1,465	274	88	0	0	0	0	0	7,167	0
1998	0	768	2,915	2,714	515	63	4	0	0	0	0	6,979	0
1999	0	201	1,982	1,520	325	60	19	0	0	0	0	4,107	0
2000	0	578	4,121	2,284	643	170	5	0	0	0	0	7,801	0
2001	0	838	1975	1781	539	121	36	4	0	0	0	5,294	4
2002	1	194	1327	1204	421	92	20	1	2	0	0	3,262	3
2003	0	237	1674	1751	648	171	62	16	0	0	0	4,559	16
2004	24	213	1554	1720	681	220	120	25	0	0	0	4,557	25
2005	3	184	1197	1539	755	238	99	60	35	0	0	4,110	95
2006	4	72	1412	1319	729	317	135	40	24	0	0	4,052	64
2007	2	70	577	1580	714	286	103	33	28	0	0	3,393	61
2008	1	25	97	437	854	520	213	77	148	0	0	2,372	225
2009	1	20	108	467	661	442	130	54	21	5	1	1,910	81
2010	0	14	49	231	575	376	153	47	23	10	6	1,484	86
2011	1	8	34	254	686	520	170	71	23	8	7	1,782	109

Table 21. Mean weight (kg) at age of summer flounder landings in the recreational fishery.

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1982	0.224	0.404	0.570	1.326	1.846	1.885	2.978	0.000	0.000	0.000	0.000	0.464
1983	0.176	0.370	0.633	0.927	1.194	1.396	0.000	0.000	0.000	0.000	0.000	0.478
1984	0.205	0.364	0.620	0.968	1.771	2.197	4.166	0.000	0.000	0.000	0.000	0.461
1985	0.242	0.398	0.626	1.101	1.748	2.441	0.000	0.000	0.000	0.000	0.000	0.533
1986	0.225	0.447	0.751	1.290	1.740	2.719	3.482	5.960	0.000	0.000	0.000	0.601
1987	0.230	0.412	0.761	1.340	1.839	3.050	4.808	4.640	0.000	0.000	0.000	0.583
1988	0.293	0.488	0.707	1.114	1.921	2.316	0.000	0.000	0.000	0.000	0.000	0.590
1989	0.263	0.512	0.813	1.232	1.784	3.333	1.576	0.000	0.000	0.000	0.000	0.742
1990	0.303	0.460	0.968	1.440	1.677	2.895	6.456	0.000	0.000	0.000	0.000	0.555
1991	0.273	0.433	0.670	1.306	1.372	2.450	0.000	0.000	0.000	0.000	0.000	0.537
1992	0.225	0.504	0.717	1.617	2.279	3.340	0.000	0.000	0.000	0.000	0.000	0.604
1993	0.246	0.518	0.715	1.872	2.442	3.027	0.000	0.000	0.000	0.000	0.000	0.619
1994	0.436	0.583	0.694	1.438	1.923	2.831	3.897	0.000	0.000	0.000	0.000	0.625
1995	0.426	0.575	0.816	1.457	2.603	2.930	3.537	0.000	0.000	0.000	0.000	0.727
1996	0.343	0.532	0.622	1.338	1.341	2.361	3.537	0.000	0.000	0.000	0.000	0.629
1997	0.225	0.487	0.675	0.909	1.153	2.377	0.000	0.000	0.000	0.000	0.000	0.732
1998	0.000	0.525	0.668	0.830	1.257	2.508	2.786	0.000	0.000	0.000	0.000	0.777
1999	0.000	0.508	0.706	0.945	1.549	2.330	2.604	0.000	0.000	0.000	0.000	0.884
2000	0.000	0.760	0.984	1.307	2.388	3.481	3.481	0.000	0.000	0.000	0.000	1.234
2001	0.000	0.621	0.879	1.037	1.539	2.089	2.291	3.738	0.000	0.000	0.000	0.998
2002	0.238	0.488	0.896	1.091	1.519	2.287	2.604	3.200	4.213	0.000	0.000	1.076
2003	0.000	0.677	0.910	1.137	1.597	2.018	2.807	2.714	0.000	0.000	0.000	1.156
2004	0.599	0.635	0.850	1.048	1.412	1.905	2.316	3.002	0.000	0.000	0.000	1.099
2005	0.308	0.571	0.869	1.133	1.408	1.756	2.330	2.357	2.269	0.000	0.000	1.173
2006	0.126	0.619	0.856	1.090	1.344	1.694	2.266	3.310	3.018	3.784	2.964	1.165
2007	0.175	0.492	0.799	1.137	1.467	1.805	2.148	2.878	3.448	3.790	3.065	1.258
2008	0.238	0.445	0.751	1.159	1.397	1.678	1.995	2.103	2.605	2.718	3.054	1.530
2009	0.207	0.424	0.866	1.085	1.265	1.666	2.114	2.507	2.660	3.173	3.641	1.396
2010	0.265	0.450	0.571	0.989	1.236	1.491	1.862	2.158	2.425	2.457	2.773	1.358
2011	0.136	0.393	0.609	0.967	1.173	1.516	1.856	1.994	2.159	2.666	2.123	1.350

Table 22. Estimated summer flounder recreational landings (catch types A + B1), live discard (catch type B2), and total catch (catch types A + B1 + B2) in numbers (000s), Proportional Standard Error (PSE) of the total catch estimate, and live discard (catch type B2) as a proportion of total catch. Catch type B2 uses estimates for North Carolina (NC) from NCDMF (C.Batsavage, pers. comm.)

Year	A+B1	B2	A+B1+B2	PSE (%)	B2 / (A+B1+B2)
1982	15,473	8,084	23,557	59	0.343
1983	20,996	11,026	32,022	16	0.344
1984	17,475	12,307	29,782	11	0.413
1985	11,066	2,460	13,526	15	0.182
1986	11,621	13,655	25,276	8	0.540
1987	7,865	13,472	21,337	6	0.631
1988	9,960	7,201	17,161	6	0.420
1989	1,717	908	2,625	10	0.346
1990	3,794	5,283	9,077	5	0.582
1991	6,068	9,870	15,938	5	0.619
1992	5,002	7,540	12,542	5	0.601
1993	6,494	17,741	24,235	5	0.732
1994	6,703	12,332	19,035	5	0.648
1995	3,326	13,568	16,894	5	0.803
1996	6,997	12,987	19,984	4	0.650
1997	7,167	13,854	21,021	4	0.659
1998	6,979	16,960	23,939	4	0.708
1999	4,107	17,833	21,940	5	0.813
2000	7,801	18,643	26,444	4	0.705
2001	5,294	24,049	29,343	3	0.820
2002	3,262	13,386	16,648	3	0.804
2003	4,559	15,776	20,335	4	0.776
2004	4,557	17,009	21,566	4	0.789
2005	4,036	23,135	27,171	5	0.851
2006	4,138	17,516	21,654	5	0.809
2007	3,394	20,428	23,822	5	0.858
2008	2,295	22,204	24,499	5	0.906
2009	1,910	23,749	25,659	5	0.926
2010	1,484	22,432	23,916	5	0.938
2011	1,782	20,361	22,143	7	0.920

Table 23. Recreational fishery sample size for summer flounder discard mortality assumption. Includes Marine Recreational Fishery Statistics Survey (MRFSS) landed fish sampling, American Littoral Society (ALS) reported released lengths, Connecticut Volunteer Angler Survey (CTVAS) reported released lengths, Massachusetts Division of Marine Fisheries party boat sampling (MADMF), NYDEC Party Boat Survey sampling (NYPBS), Maryland Department of Natural Resources Volunteer Angler Logs (MDVAL), and MRF For-Hire Survey (MRF FHS) reported released lengths. Number of MRFSS lengths is for landed fish measured that were less than the state or federal minimum landed size, and assumed to be indicative of the length frequency of the discarded catch. This length frequency was used to characterize the length frequency of the released catch. All other sources of released lengths were used to verify this assumption. In 2002 and 2003, samples of discarded summer flounder from CTVAS and NYPBS used to directly characterize the discard in those states. The MRF FHS began sampling in 2005. B2 mt estimates use NC from NCDMF (C. Batsavage, pers. comm.).

Year	Source	Discard Mortality (B2; mt)	Number of Lengths	mt/100 Lengths
1982	MRFSS		2,048	
	ALS		1	
	Total	296	2,049	14
1983	MRFSS		2,683	
	ALS			
	Total	376	2,683	14
1984	MRFSS		1,521	
	ALS		1,134	
	Total	415	2,683	15
1985	MRFSS		1,032	
	ALS		695	
	Total	92	1,727	5
1986	MRFSS		976	
	ALS		1,445	
	Total	578	2,421	24
1987	MRFSS		1,164	
	ALS		1,496	
	Total	522	2,660	20
1988	MRFSS		1,065	
	ALS		1,640	
	Total	341	2,705	13
1989	MRFSS		448	
	ALS		171	
	Total	45	619	7

Table 23, continued. Recreational fishery sample size for summer flounder discard mortality assumption. Includes Marine Recreational Fishery Statistics Survey (MRFSS) landed fish sampling, American Littoral Society (ALS) reported released lengths, CT Volunteer Angler Survey (CTVAS) reported released lengths, Massachusetts Division of Marine Fisheries party boat sampling (MADMF), NYDEC Party Boat Survey sampling (NYPBS), Maryland Department of Natural Resources Volunteer Angler Logs (MDVAL), and MRF For-Hire Survey (MRF FHS) reported released lengths. Number of MRFSS lengths is for landed fish measured that were less than the state or federal minimum landed size, and assumed to be indicative of the length frequency of the discarded catch. This length frequency was used to characterize the length frequency of the released catch. All other sources of released lengths were used to verify this assumption. In 2002 and 2003, samples of discarded summer flounder from CTVAS and NYPBS used to directly characterize the discard in those states. The MRF FHS began sampling in 2005. B2 mt estimates use NC from NCDMF (C. Batsavage, pers. comm.)

Year	Source	Discard Mortality (B2; mt)	Number of Lengths	mt/100 Lengths
1990	MRFSS		1,588	
	ALS		1,318	
	Total	234	2,906	8
1991	MRFSS		2,230	
	ALS		2,126	
	Total	429	4,356	10
1992	MRFSS		1,401	
	ALS		1,807	
	Total	344	3,208	11
1993	MRFSS		966	
	ALS		3,923	
	Total	910	4,889	19
1994	MRFSS		1,079	
	ALS		3,061	
	Total	687	4,140	17
1995	MRFSS		267	
	ALS		2,307	
	Total	753	2,574	29
1996	MRFSS		639	
	ALS		2,383	
	Total	681	3,022	23
1997	MRFSS		221	
	ALS		2,468	
	Total	556	2,689	21
1998	MRFSS		1,083	
	ALS		3,015	
	Total	734	4,098	18
1999	MRFSS		429	
	ALS		3,688	
	Total	711	4,117	17

Table 23, continued. Recreational fishery sample size for summer flounder discard mortality assumption. Includes Marine Recreational Fishery Statistics Survey (MRFSS) landed fish sampling, American Littoral Society (ALS) reported released lengths, CT Volunteer Angler Survey (CTVAS) reported released lengths, Massachusetts Division of Marine Fisheries party boat sampling (MADMF), NYDEC Party Boat Survey sampling (NYPBS), Maryland Department of Natural Resources Volunteer Angler Logs (MDVAL), and MRF For-Hire Survey (MRF FHS) reported released lengths. Number of MRFSS lengths is for landed fish measured that were less than the state or federal minimum landed size, and assumed to be indicative of the length frequency of the discarded catch. This length frequency was used to characterize the length frequency of the released catch. All other sources of released lengths were used to verify this assumption. In 2002 and 2003, samples of discarded summer flounder from CTVAS and NYPBS used to directly characterize the discard in those states. The MRF FHS began sampling in 2005. B2 mt estimates use NC from NCDMF (C. Batsavage, pers. comm.)

Year	Source	Discard Mortality (B2; mt)	Number of Lengths	mt/100 Lengths
2000	MRFSS		421	
	ALS		5,962	
	CTVAS		2,893	
	NYPBS		681	
	Total	952	9,957	10
2001	MRFSS		637	
	ALS		3,453	
	CTVAS		999	
	NYPBS		834	
	MDVAL		2,316	
	Total	1,274	8,239	15
2002	MRFSS		721	
	CTVAS		1,526	
	ALS		2,931	
	NYPBS		1,840	
	MADMF		12	
	Total	777	7,030	11
2003	MRFSS		215	
	ALS		2,466	
	CTVAS		1,407	
	NYPBS		2,167	
	Total	882	6,255	14
2004	MRFSS		321	
	ALS		2,153	
	CTVAS		661	
	NYPBS		1,222	
	Total	1,034	4,357	24
2005	MRFSS		142	
	ALS		3,398	
	CTVAS		1,199	
	MRF FHS		3,210	
	Total	999	7,949	13

Table 23, continued. Recreational fishery sample size for summer flounder discard mortality assumption. Includes Marine Recreational Fishery Statistics Survey (MRFSS) landed fish sampling, American Littoral Society (ALS) reported released lengths, CT Volunteer Angler Survey (CTVAS) reported released lengths, Massachusetts Division of Marine Fisheries party boat sampling (MADMF), NYDEC Party Boat Survey sampling (NYPBS), Maryland Department of Natural Resources Volunteer Angler Logs (MDVAL), and MRF For-Hire Survey (MRF FHS) reported released lengths. Number of MRFSS lengths is for landed fish measured that were less than the state or federal minimum landed size, and assumed to be indicative of the length frequency of the discarded catch. This length frequency was used to characterize the length frequency of the released catch. All other sources of released lengths were used to verify this assumption. In 2002 and 2003, samples of discarded summer flounder from CTVAS and NYPBS used to directly characterize the discard in those states. The MRF FHS began sampling in 2005. B2 mt estimates use NC from NCDMF (C. Batsavage, pers. comm.)

Year	Source	Discard Mortality (B2; mt)	Number of Lengths	mt/100Lengths
2006	MRFSS		180	
	ALS		3,104	
	CTVAS		1,124	
	MDVAL		2,944	
	MRF FHS		2,924	
	Total	795	10,276	8
2007	MRFSS		266	
	ALS		4,072	
	CTVAS		1,038	
	MRF FHS		3,364	
	Total	1,130	8,740	13
2008	MRFSS		224	
	ALS		5,437	
	CTVAS		843	
	MRF FHS		3,353	
	Total	1,251	9,857	13
2009	MRFSS		167	
	ALS		4,873	
	CTVAS		1,023	
	NJVAS		1,918	
	MDVAS		5,466	
	VAVAS		928	
	MRF FHS		3,366	
	Total	1,195	17,741	7
2010	MRFSS		147	
	ALS		6,469	
	CTVAS		973	
	NJVAS		2,412	
	MRF FHS		3,722	
	Total	1,079	13,723	8
2011	MRFSS		129	
	ALS		5,133	
	NJVAS		2,867	
	MRF FHS		3,404	
	Total	1,074	11,533	9

Table 24. Estimated recreational fishery discards at age of summer flounder (catch type B2). North Carolina estimates by North Carolina Division of Marine Fisheries (NCMDF). Discards during 1982-1996 allocated to age groups in same relative proportions as ages 0 and 1 in the subregional catch. Discards during 1997-2000 allocated to age groups in same relative proportions as fish less than the annual EEZ minimum size in the subregional catch. Discards in 2001-2009 allocated to age groups in the same relative proportion as fish less than the minimum size in the respective state catch from Marine Recreational Fishery Statistics Survey sampling and as indicated by state agency or American Littoral Society (ALS) sampling of the released catch. All years assume 10% release mortality.

Year	0	1	2	3	4	5	6	7	8	9	10	Total	7+ N
1982	172	636	0	0	0	0	0	0	0	0	0	808	0
1983	175	932	0	0	0	0	0	0	0	0	0	1107	0
1984	210	1,020	0	0	0	0	0	0	0	0	0	1230	0
1985	40	206	0	0	0	0	0	0	0	0	0	246	0
1986	150	1,217	0	0	0	0	0	0	0	0	0	1367	0
1987	106	1,210	0	0	0	0	0	0	0	0	0	1316	0
1988	55	665	0	0	0	0	0	0	0	0	0	720	0
1989	13	83	0	0	0	0	0	0	0	0	0	96	0
1990	60	470	0	0	0	0	0	0	0	0	0	530	0
1991	24	977	0	0	0	0	0	0	0	0	0	1001	0
1992	17	674	0	0	0	0	0	0	0	0	0	691	0
1993	34	1,740	0	0	0	0	0	0	0	0	0	1774	0
1994	216	1,017	0	0	0	0	0	0	0	0	0	1233	0
1995	189	1,168	0	0	0	0	0	0	0	0	0	1357	0
1996	50	1,249	0	0	0	0	0	0	0	0	0	1299	0
1997	24	820	522	23	0	0	0	0	0	0	0	1389	0
1998	0	685	875	136	0	0	0	0	0	0	0	1696	0
1999	84	587	987	125	0	0	0	0	0	0	0	1783	0
2000	0	587	1097	180	0	0	0	0	0	0	0	1864	0
2001	0	1261	888	239	17	0	0	0	0	0	0	2405	0
2002	75	565	569	190	8	0	0	0	0	0	0	1407	0
2003	49	785	599	194	14	0	0	0	0	0	0	1641	0
2004	85	508	794	307	7	0	0	0	0	0	0	1701	0
2005	254	1153	739	160	8	0	0	0	0	0	0	2314	0
2006	155	552	887	145	13	2	0	0	0	0	0	1754	0
2007	101	667	674	514	65	7	0	0	0	0	0	2028	0
2008	140	807	609	398	246	45	10	3	2	2	0	2262	7
2009	218	897	626	440	162	28	2	1	1	0	0	2375	2
2010	150	808	594	450	194	35	7	2	1	1	1	2243	5
2011	97	481	570	595	241	41	5	3	1	1	1	2036	6

Table 25. Mean weight (kg) at age of summer flounder discards in the recreational fishery.

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1982	0.224	0.404	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.366
1983	0.176	0.370	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.339
1984	0.205	0.364	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.337
1985	0.242	0.398	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.373
1986	0.225	0.447	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.423
1987	0.230	0.412	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.397
1988	0.293	0.488	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.473
1989	0.263	0.512	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.478
1990	0.303	0.460	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.442
1991	0.273	0.433	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.429
1992	0.225	0.504	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.497
1993	0.246	0.518	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.513
1994	0.436	0.586	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.560
1995	0.426	0.575	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.554
1996	0.343	0.532	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.525
1997	0.225	0.394	0.417	0.423	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.400
1998	0.000	0.400	0.453	0.469	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.433
1999	0.127	0.378	0.427	0.455	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.399
2000	0.000	0.478	0.523	0.540	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.510
2001	0.000	0.472	0.570	0.667	0.756	0.000	0.000	0.000	0.000	0.000	0.000	0.530
2002	0.206	0.419	0.665	0.737	0.807	1.893	0.000	0.000	0.000	0.000	0.000	0.552
2003	0.169	0.420	0.645	0.737	1.040	0.000	0.000	0.000	0.000	0.000	0.000	0.537
2004	0.255	0.454	0.678	0.769	1.078	0.000	0.000	0.000	0.000	0.000	0.000	0.608
2005	0.207	0.358	0.550	0.736	1.118	0.000	0.000	0.000	0.000	0.000	0.000	0.432
2006	0.157	0.348	0.523	0.686	0.919	1.389	0.000	0.000	0.000	0.000	0.000	0.453
2007	0.170	0.336	0.593	0.802	1.024	1.483	0.000	0.000	0.000	0.000	0.000	0.557
2008	0.184	0.349	0.558	0.742	0.897	1.162	1.634	2.321	2.506	3.354	0.000	0.553
2009	0.167	0.315	0.549	0.774	0.948	1.167	1.316	1.415	1.405	0.000	0.000	0.503
2010	0.162	0.294	0.466	0.686	0.854	1.156	1.623	2.272	3.203	3.427	2.567	0.481
2011	0.177	0.302	0.479	0.622	0.816	1.154	1.775	2.232	2.683	3.217	2.536	0.527

Table 26. Estimated total landings (catch types A + B1) of summer flounder by recreational fishermen as estimated by the Marine Recreational Information Program (MRIP). SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate. MRIP Estimates are currently available only for 2004-2011.

STATE	2004	2005	2006	2007	2008	2009	2010	2011
CT	216,154	156,724	137,521	112,227	145,661	44,944	35,028	53,421
Shore	4,523	2,500	7,193	0	0	0	0	0
P/C Boat	3,155	423	0	2,020	866		436	164
P/R Boat	208,476	153,801	130,328	110,206	144,795	44,944	34,592	53,258
DE	111,362	72,696	88,149	108,264	35,227	87,232	53,512	80,897
Shore	1,271	2,418	4,822	3,565	3,028	2,535	4,748	2,111
P/C Boat	6,318	6,307	4,938	11,840	1,636	11,004	1,220	878
P/R Boat	103,773	63,971	78,388	92,859	30,562	73,693	47,544	77,908
MD	42,261	117,021	37,471	103,849	57,895	64,647	25,215	17,615
Shore	5,105	10,485	1,770	47,280	11,102	9,186	685	6,051
P/C Boat	1,134	1,974	2,537	3,057	3,866	2,072	1,111	2,401
P/R Boat	36,022	104,563	33,164	53,512	42,927	53,389	23,419	9,163
MA	224,729	267,081	238,970	138,071	232,285	50,382	45,156	76,610
Shore	0	4,344	5,819	0	0	633		0
P/C Boat	1,144	4,118	22,544	9,970	1,161	2,703	4,609	1,435
P/R Boat	223,585	258,619	210,607	128,101	231,124	47,046	40,547	75,175
NH	0	0	717	0	562	0	0	0
Shore	0	0	0	0	0	0	0	0
P/R Boat	0	0	717	0	562	0	0	0
NJ	1,616,811	1,300,223	1,556,151	1,067,404	761,843	824,887	552,401	724,828
Shore	37,807	20,662	63,429	19,586	11,171	23,586	19,901	15,294
P/C Boat	147,120	163,348	189,475	195,448	68,163	97,872	85,225	73,260
P/R Boat	1,431,885	1,116,213	1,303,247	852,370	682,509	703,429	447,274	636,275
NY	1,024,670	1,163,329	752,388	865,957	608,925	298,634	334,491	369,962
Shore	60,216	22,407	20,283	0	5,748	8,645	1,588	0
P/C Boat	203,595	283,229	71,959	198,898	53,498	50,505	41,927	24,504
P/R Boat	760,859	857,693	660,146	667,059	549,679	239,483	290,976	345,458
NC	156,967	101,289	113,340	140,296	43,537	75,538	77,431	61,323
Shore	52,899	16,062	31,139	12,842	17,179	13,653	23,347	9,925
P/C Boat	469	2,305	1,383	20,233	27	897	1,271	1,553
P/R Boat	103,599	82,922	80,817	107,221	26,331	60,988	52,813	49,844
RI	248,988	164,909	264,142	175,778	203,745	71,739	118,455	141,312
Shore	13,811	4,055	4,896	459	0	0	1,940	528
P/C Boat	17,807	32,491	16,222	53,383	39,093	9,151	12,287	18,850
P/R Boat	217,371	128,363	243,024	121,936	164,652	62,587	104,228	121,934
VA	674,552	684,272	762,597	397,041	260,221	289,075	260,050	304,289
Shore	24,735	21,364	15,061	14,687	31,111	4,452	7,603	4,775
P/C Boat	83,034	4,496	8,040	5,619	3,668	3,692	12,296	4,655
P/R Boat	566,783	658,412	739,496	376,735	225,442	280,931	240,151	294,859
TOTAL	4,316,495	4,027,544	3,951,446	3,108,887	2,349,901	1,807,077	1,501,739	1,830,258
PSE (%)	6	6	7	6	9	7	8	8

Table 27. Percentage difference in estimated total landings (catch types A + B1) of summer flounder by recreational fishermen as estimated by the Marine Recreational Fisheries Statistics Survey (MRSSS) and Marine Recreational Information Program (MRIP) ([MRIP-MRFSS]/MRFSS) by state and fishing mode. Positive value indicates MRIP estimate is larger. SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats.

MRIP-MRFSS (delta %)

	2004	2005	2006	2007	2008	2009	2010	2011	TOTAL
CT	0%	-26%	28%	3%	26%	-27%	-12%	-15%	-2.6%
Shore	33%	85%	81%			-100%			23.3%
P/C Boat	3%	-77%		23%	1%		-17%	56%	-11.7%
P/R Boat	-1%	-27%	26%	3%	26%	-24%	-12%	-15%	-2.9%
DE	-10%	-20%	-20%	-8%	7%	-5%	-26%	-15%	-13.2%
Shore	18%	-15%	-39%	-40%	32%	-28%	-24%	-19%	-24.3%
P/C Boat	-19%	-27%	7%	15%	-2%	-1%	-10%	3%	-4.8%
P/R Boat	-10%	-19%	-20%	-9%	5%	-5%	-26%	-15%	-13.2%
MD	-36%	37%	-36%	-34%	-35%	-28%	-36%	-39%	-24.2%
Shore	-38%	-18%	-67%	-17%	-26%	71%	104%	52%	-15.1%
P/C Boat	-73%	58%	10%	16%	65%	-37%	-29%	101%	-3.1%
P/R Boat	-33%	47%	-35%	-45%	-41%	-34%	-37%	-62%	-27.0%
MA	-20%	31%	9%	82%	55%	4%	3%	80%	19.7%
Shore	-100%	-73%	25%			-68%			-61.0%
P/C Boat		149%	4%	47%	-42%	26%	-16%	37%	16.7%
P/R Boat	-19%	40%	9%	85%	56%	7%	6%	81%	22.1%
NH			-52%		-46%				-49.7%
Shore									
P/R Boat			-52%		-46%				-49.7%
NJ	-14%	-7%	0%	-20%	-11%	-19%	-4%	-8%	-10.6%
Shore	-50%	-47%	71%	-37%	49%	-12%	14%	-26%	-17.3%
P/C Boat	-32%	-5%	-9%	29%	27%	-17%	32%	12%	-2.8%
P/R Boat	-10%	-6%	-1%	-26%	-14%	-19%	-10%	-9%	-11.4%
NY	9%	1%	-6%	22%	8%	13%	29%	28%	8.9%
Shore	87%	-4%	-2%		-38%	-12%	-22%		22.2%
P/C Boat	-11%	13%	-38%	27%	31%	17%	48%	-5%	4.3%
P/R Boat	13%	-2%	-1%	20%	7%	13%	27%	32%	9.6%
NC	-9%	-21%	-26%	-24%	-18%	30%	-16%	-7%	-15.2%
Shore	15%	8%	22%	-8%	-7%	13%	8%	-23%	6.9%
P/C Boat	-86%	23%	-36%	2%	-94%	-14%	0%	-21%	-12.0%
P/R Boat	-16%	-26%	-35%	-29%	-23%	36%	-24%	-2%	-20.5%
RI	-14%	-12%	0%	-24%	-1%	40%	40%	-1%	-4.7%
Shore	4%	-14%	53%	-76%			23%	-67%	-2.3%
P/C Boat	-20%	15%	-14%	16%	29%	-4%	-4%	13%	7.9%
P/R Boat	-14%	-17%	1%	-34%	-7%	50%	49%	-2%	-6.6%
VA	16%	17%	-12%	-17%	14%	25%	-6%	13%	3.3%
Shore	-4%	-30%	-22%	-72%	81%	-32%	-23%	-44%	-27.0%
P/C Boat	707%	-51%	18%	-24%	-22%	18%	85%	14%	140.3%
P/R Boat	3%	21%	-12%	-10%	9%	26%	-7%	15%	2.7%
TOTAL	-5.3%	-0.2%	-4.5%	-8.4%	2.4%	-5.4%	1.2%	2.7%	-3.0%

Table 28. Estimated total landings (catch types A + B1, metric tons) of summer flounder by recreational fishermen as estimated by the Marine Recreational Information Program (MRIP). SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate. MRIP Estimates are currently available only for 2004-2011.

STATE	2004	2005	2006	2007	2008	2009	2010	2011
CT	248	195	197	168	256	89	60	94
Shore	4	3	12	0	0	0	0	0
P/C Boat	4	1	0	3	1	0	1	0
P/R Boat	240	191	185	165	254	89	59	94
DE	137	95	112	148	65	118	73	97
Shore	2	4	5	5	6	3	7	3
P/C Boat	9	8	6	16	3	16	2	1
P/R Boat	126	83	101	127	56	99	64	94
MD	41	126	33	93	71	75	41	24
Shore	6	9	2	37	13	11	1	8
P/C Boat	1	2	2	3	5	2	2	3
P/R Boat	34	115	29	53	53	62	38	14
MA	280	284	278	166	283	56	51	89
Shore	0	4	7	0	0	1	0	0
P/C Boat	1	4	28	12	1	3	6	1
P/R Boat	279	276	243	155	282	52	45	87
NH	0	0	1	0	0	0	0	0
Shore	0	0	0	0	0	0	0	0
P/R Boat	0	0	1	0	0	0	0	0
NJ	1,765	1,449	1,782	1,239	952	1,117	731	928
Shore	32	20	52	22	17	22	24	19
P/C Boat	175	219	245	215	91	135	112	102
P/R Boat	1,559	1,210	1,485	1,002	844	960	595	807
NY	1,252	1,703	1,076	1,442	1,242	645	734	767
Shore	63	33	27	0	6	17	7	0
P/C Boat	259	430	100	338	104	103	86	46
P/R Boat	930	1,240	950	1,103	1,132	524	640	720
NC	100	66	74	100	29	48	51	47
Shore	33	11	23	8	11	8	14	8
P/C Boat	0	1	1	16	0	1	1	1
P/R Boat	67	54	50	75	18	39	36	38
RI	364	227	356	250	372	157	219	212
Shore	19	5	6	1	0	0	3	1
P/C Boat	23	43	23	71	66	20	25	32
P/R Boat	322	179	326	178	306	136	192	180
VA	786	785	894	594	418	413	358	387
Shore	23	24	14	18	59	3	9	7
P/C Boat	119	5	8	7	6	5	20	6
P/R Boat	645	756	872	569	354	405	328	374
TOTAL	4,974	4,929	4,804	4,199	3,689	2,716	2,317	2,645
PSE (%)	6	6	6	7	8	11	13	12

Table 29. Percentage difference in estimated total landings (catch types A + B1, metric tons) of summer flounder by recreational fishermen as estimated by the Marine Recreational Fisheries Statistics Survey and Marine Recreational Information Program ([MRIP-MRFSS]/MRFSS) by state and fishing mode. Positive value indicates MRIP estimate is larger. SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats.

MRIP-MRFSS (delta%)

	2004	2005	2006	2007	2008	2009	2010	2011	TOTAL
CT	-3%	-27%	27%	3%	31%	-33%	-15%	-12%	-3.1%
Shore	33%	72%	173%			-100%			24.9%
P/C Boat	18%	-74%		26%	1%		34%	93%	2.0%
P/R Boat	-4%	-27%	23%	2%	31%	-30%	-16%	-13%	-3.4%
DE	-6%	-20%	-13%	-10%	6%	-2%	-26%	-12%	-10.9%
Shore	6%	42%	-35%	-34%	27%	-28%	-16%	-22%	-15.1%
P/C Boat	71%	-27%	8%	23%	10%	4%	-14%	6%	8.7%
P/R Boat	-10%	-21%	-12%	-12%	4%	-2%	-28%	-11%	-12.0%
MD	-37%	130%	-35%	-34%	-38%	-27%	-36%	-31%	-20.0%
Shore	-32%		-63%	-19%	-40%	77%		75%	-6.0%
P/C Boat	-59%	83%	23%	31%	59%	-29%	-34%	97%	11.7%
P/R Boat	-37%	115%	-34%	-44%	-41%	-34%	-38%	-53%	-23.6%
MA	-23%	30%	-17%	77%	48%	-2%	-7%	52%	8.4%
Shore	-100%	-29%	24%			-73%			-39.1%
P/C Boat		117%	9%	21%	-46%	20%	-13%	26%	11.4%
P/R Boat	-22%	31%	-20%	84%	50%	0%	-6%	53%	8.9%
NH			-56%		-46%				-53.4%
Shore									
P/R Boat			-56%		-46%				-53.4%
NJ	-7%	-5%	-7%	-22%	-15%	-18%	-5%	-8%	-11.0%
Shore	-58%	-48%	78%	-32%	67%	-9%	3%	-24%	-19.3%
P/C Boat	34%	14%	1%	27%	18%	-15%	32%	21%	13.5%
P/R Boat	-8%	-6%	-10%	-27%	-18%	-19%	-10%	-10%	-13.6%
NY	21%	5%	-7%	24%	9%	10%	27%	27%	12.3%
Shore	83%	36%	-4%		-46%	-19%	62%		24.4%
P/C Boat	69%	23%	-37%	44%	36%	18%	70%	-1%	26.7%
P/R Boat	9%	-1%	-3%	19%	8%	10%	23%	30%	9.5%
NC	-10%	-20%	-22%	-24%	-21%	22%	-18%	-5%	-15.2%
Shore	8%	4%	37%	-11%	-12%	2%	1%	-14%	4.9%
P/C Boat	-92%	-20%	-33%	3%	-95%	-18%	30%	-8%	-15.6%
P/R Boat	-13%	-24%	-34%	-29%	-25%	28%	-25%	-3%	-19.9%
RI	-4%	-9%	-8%	-23%	1%	40%	39%	0%	-1.5%
Shore	28%	-7%	332%	-73%			-4%	-74%	16.2%
P/C Boat	65%	13%	-9%	13%	28%	-2%	-3%	12%	13.9%
P/R Boat	-9%	-13%	-10%	-31%	-3%	49%	48%	-1%	-4.0%
VA	19%	18%	-11%	-16%	16%	23%	-6%	8%	3.6%
Shore	-13%	-32%	31%	-64%	117%	-36%	-19%	-45%	-12.1%
P/C Boat	2044%	-53%	11%	-33%	-19%	17%	114%	10%	190.6%
P/R Boat	3%	22%	-12%	-12%	9%	23%	-9%	10%	1.6%
TOTAL	1%	3%	-8%	-6%	3%	-5%	4%	4%	-1.3%

Table 30. Estimated total live releases (catch type B2) of summer flounder by recreational fishermen as estimated by the Marine Recreational Information Program (MRIP). SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate. MRIP Estimates are currently available only for 2004-2011.

	2004	2005	2006	2007	2008	2009	2010	2011
CT	269,617	778,857	1,111,460	297,486	990,604	428,159	373,075	319,973
Shore	37,742	15,055	19,236	3,887	1,748	9,817	37,667	8,270
P/C Boat	6,500	963	399	3,416	648		1,282	12
P/R Boat	225,375	762,839	1,091,825	290,182	988,208	418,342	334,127	311,692
DE	737,214	795,130	445,165	1,071,823	604,647	963,700	618,711	601,611
Shore	45,244	64,748	20,179	50,300	65,578	71,566	89,956	73,406
P/C Boat	16,886	32,919	14,060	24,010	9,379	28,762	12,355	3,583
P/R Boat	675,083	697,463	410,926	997,513	529,690	863,372	516,400	524,621
ME							65	
P/C Boat							65	
MD	806,075	360,963	252,483	1,018,330	922,577	816,487	1,225,452	486,095
Shore	178,759	157,364	50,808	335,274	330,253	273,923	573,455	237,207
P/C Boat	34,142	2,523	18,501	22,838	35,510	36,540	29,642	25,500
P/R Boat	593,173	201,077	183,174	660,218	556,814	506,024	622,354	223,388
MA	348,478	358,046	610,373	135,351	273,021	96,356	214,713	221,512
Shore	18,132	128,401	66,200	9,655	2,955	893		45,565
P/C Boat	1,279	9,721	23,359	3,252	1,952	5,171	5,915	2,495
P/R Boat	329,067	219,924	520,814	122,445	268,114	90,292	208,798	173,451
NH	265	1,809	301	218	280	762		
Shore	225			218				
P/R Boat	40	1,809	301		280	762		
NJ	6,701,873	8,939,286	6,739,513	6,192,157	8,959,312	10,414,443	10,564,678	8,247,828
Shore	408,818	779,906	422,346	674,706	460,593	638,629	1,317,649	1,431,155
P/C Boat	412,847	571,270	1,005,129	541,215	486,027	570,680	535,783	550,498
P/R Boat	5,880,207	7,588,110	5,312,038	4,976,236	8,012,692	9,205,133	8,711,246	6,266,174
NY	3,182,287	7,753,367	4,945,661	5,271,601	5,521,407	5,563,769	6,571,251	7,666,674
Shore	100,118	181,011	48,666	184,804	426,756	286,374	273,002	235,356
P/C Boat	475,156	1,108,245	553,581	629,274	502,558	477,480	358,193	586,829
P/R Boat	2,607,013	6,464,111	4,343,415	4,457,523	4,592,093	4,799,914	5,940,055	6,844,489
NC	0	1,755	55,117	4,249	4,411	10,959	15,687	5,417
Shore	0	0	16,886	0	2,364	0	149	403
P/C Boat	0	148	3,562	2,820	2,048	10,959	13,660	4,326
P/R Boat	0	1,608	34,670	1,430	0	0	1,877	689
RI	277,293	280,034	1,129,097	612,107	848,075	382,262	230,311	797,361
Shore	18,088	6,423	58,039	15,812	16,739	7,783	34,806	5,899
P/C Boat	11,841	33,821	45,119	108,834	100,541	38,053	23,161	34,108
P/R Boat	247,364	239,789	1,025,939	487,462	730,796	336,425	172,344	757,354
VA	3,696,609	2,509,013	2,164,118	3,023,421	2,424,687	3,613,064	2,419,838	2,089,498
Shore	849,401	504,097	200,203	444,811	248,877	893,987	282,305	235,368
P/C Boat	75,435	17,274	18,999	26,030	33,536	49,049	40,038	21,261
P/R Boat	2,771,774	1,987,643	1,944,916	2,552,580	2,142,273	2,670,028	2,097,495	1,832,869
TOTAL	16,019,710	21,778,262	17,453,288	17,626,743	20,549,020	22,289,961	22,233,782	20,435,970

Table 31. Percentage difference in estimated total live releases (catch type B2) of summer flounder by recreational fishermen as estimated by the Marine Recreational Fisheries Statistics Survey and Marine Recreational Information Program. ([MRIP-MRFSS]/MRFSS) by state and fishing mode. Positive value indicates MRIP estimate is larger. SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats.

MRIP-MRFSS (delta)

STATE	2004	2005	2006	2007	2008	2009	2010	2011	TOTAL
CT	-26%	-7%	23%	-8%	25%	-22%	-16%	-24%	-1%
Shore	61%	-13%	12%	-56%	52%	-18%	60%	48%	22%
P/C Boat	87%	-74%	12%	18%	32%		-40%	-32%	2%
P/R Boat	-33%	-7%	24%	-7%	25%	-23%	-20%	-25%	-2%
DE	-13%	-5%	-17%	-2%	-16%	-2%	-20%	-16%	-10%
Shore	-42%	-10%	-34%	-23%	-43%	-20%	-36%	-24%	-30%
P/C Boat	-9%	-32%	30%	36%	7%	9%	-7%	-2%	-4%
P/R Boat	-10%	-3%	-16%	-2%	-11%	0%	-17%	-14%	-8%
ME							59%		59%
P/C Boat							59%		59%
MD	-15%	-17%	-51%	-37%	-29%	-21%	-25%	-31%	-28%
Shore	-31%	-23%	-67%	-33%	-15%	12%	3%	-10%	-17%
P/C Boat	-40%	11%	32%	92%	45%	-25%	-30%	19%	-7%
P/R Boat	-7%	-12%	-46%	-41%	-38%	-31%	-40%	-46%	-34%
MA	-10%	16%	10%	37%	51%	-21%	52%	69%	17%
Shore	13%	-18%	50%	6%	-73%	-30%		20%	-1%
P/C Boat	88%	166%	2%	40%	-31%	-4%	-31%	21%	10%
P/R Boat	-11%	48%	6%	40%	60%	-22%	57%	90%	21%
NH	38%	25%	-50%	-48%	35%	220%			17%
Shore	112%			-48%					-16%
P/R Boat	-54%	25%	-50%		35%	220%			23%
NJ	-7%	-10%	-1%	-13%	-4%	-8%	-1%	-1%	-6%
Shore	-34%	11%	60%	12%	34%	-8%	8%	13%	7%
P/C Boat	-3%	8%	5%	31%	37%	4%	14%	3%	10%
P/R Boat	-5%	-13%	-5%	-19%	-7%	-8%	-3%	-4%	-8%
NY	19%	0%	-6%	0%	-10%	-4%	8%	10%	1%
Shore	15%	-62%	-38%	3%	42%	-3%	17%	-30%	-13%
P/C Boat	43%	23%	-42%	51%	0%	13%	9%	-1%	5%
P/R Boat	15%	1%	2%	-4%	-14%	-5%	8%	13%	1%
NC		-3%	-19%	-10%	41%	-16%	-17%	-12%	-16%
Shore			40%		176%		-61%	-71%	35%
P/C Boat		-14%	-14%	-15%	-10%	-16%	-7%	-3%	-11%
P/R Boat		-2%	-34%	3%			-50%	134%	-32%
RI	-7%	-18%	8%	-29%	-12%	10%	7%	-5%	-7%
Shore	10%	-75%	12%	-54%	19%	10%	101%	-8%	-6%
P/C Boat	-12%	13%	-12%	26%	49%	3%	-4%	18%	17%
P/R Boat	-7%	-16%	9%	-35%	-18%	11%	-1%	-6%	-9%
VA	4%	7%	-5%	-11%	-12%	13%	-2%	9%	0%
Shore	32%	17%	-41%	11%	-10%	20%	-6%	-7%	8%
P/C Boat	170%	-31%	39%	-28%	-23%	4%	-11%	-4%	8%
P/R Boat	-3%	5%	1%	-14%	-12%	11%	-1%	12%	-1%
TOTAL	-2%	-4%	-3%	-11%	-7%	-4%	-1%	2%	-4%

Table 32. Total catch at age of summer flounder (000s), Maine to North Carolina.

Year	0	1	2	3	4	5	6	7	8	9	10	Total	7+
1982	5344	19423	10149	935	328	117	66	26	4	0	0	36392	30
1983	4925	28441	10911	2181	693	323	16	36	5	2	0	47533	43
1984	4802	26582	15454	3180	829	94	5	5	1	4	0	50956	10
1985	2078	14623	17979	1767	496	252	30	5	2	1	0	37233	8
1986	1943	17141	11056	3783	316	140	58	8	3	0	0	34448	11
1987	1138	17214	10840	1649	544	25	29	27	11	0	0	31477	38
1988	789	20440	14528	2138	642	121	19	15	6	0	0	38698	21
1989	960	4790	7306	1692	353	55	9	3	1	0	0	15169	4
1990	1856	8808	2187	995	221	31	7	2	1	0	0	14108	3
1991	1001	12149	7148	742	217	32	3	1	0	0	0	21294	1
1992	1368	11197	6026	1128	151	69	2	1	0	0	0	19942	1
1993	1305	12025	5943	586	74	46	19	2	1	0	0	20001	3
1994	1702	10648	7145	995	207	27	13	0	5	0	0	20742	5
1995	607	5832	7303	1236	396	77	5	1	0	0	0	15457	1
1996	189	6803	9081	1767	411	72	16	1	3	1	0	18344	5
1997	36	2614	8078	3152	553	160	10	4	0	0	0	14607	4
1998	45	2370	6422	5249	980	138	19	1	0	0	0	15224	1
1999	181	2204	6293	4021	1161	358	55	14	0	0	0	14287	14
2000	22	1591	8010	4680	1529	370	74	19	8	1	1	16305	29
2001	11	2983	4779	3739	1293	363	123	26	4	1	2	13324	33
2002	89	1368	5396	3886	1314	318	135	22	2	1	0	12531	25
2003	51	1799	4977	4066	1581	561	232	65	17	2	1	13352	85
2004	111	1071	5699	4708	1907	768	303	112	34	7	4	14724	157
2005	261	1901	3876	4212	2265	1069	517	264	165	38	24	14592	491
2006	163	1066	5137	3284	1796	869	372	123	48	6	2	12866	179
2007	112	938	2213	4217	1645	670	284	106	55	8	5	10253	174
2008	144	1033	1315	1841	2535	1069	474	210	193	13	4	8831	420
2009	221	1100	1630	2332	2054	1302	401	146	71	17	7	9281	241
2010	164	1110	1652	2589	2443	1132	557	185	85	46	41	10004	357
2011	101	613	1604	3081	3150	1581	600	336	137	48	31	11281	551

Table 33. Mean weight (kg) at age of summer flounder catch, Maine to North Carolina.

Year	0	1	2	3	4	5	6	7	8	9	10	Total	7+
1982	0.255	0.419	0.616	1.447	1.906	2.787	2.668	3.762	4.284	0.000	0.000	0.504	3.831
1983	0.244	0.419	0.716	1.075	1.257	1.495	2.567	3.221	3.875	4.370	0.000	0.522	3.351
1984	0.251	0.398	0.632	1.046	1.500	2.163	3.456	3.620	4.640	4.030	0.000	0.518	3.886
1985	0.290	0.429	0.613	1.109	1.726	2.297	2.671	4.682	4.780	4.800	0.000	0.575	4.721
1986	0.256	0.454	0.668	1.160	1.739	1.994	3.310	2.994	4.415	0.000	0.000	0.613	3.382
1987	0.263	0.446	0.651	1.140	1.941	2.862	3.378	3.020	4.140	0.000	0.000	0.580	3.344
1988	0.319	0.462	0.624	1.130	1.738	2.486	3.888	3.539	4.319	0.000	0.000	0.588	3.762
1989	0.207	0.459	0.723	1.044	1.479	2.248	2.408	2.861	2.251	0.000	0.000	0.668	2.709
1990	0.250	0.429	0.810	1.169	1.538	2.143	3.024	3.944	5.029	0.000	0.000	0.540	4.305
1991	0.140	0.404	0.702	1.186	1.812	2.519	2.975	3.660	0.000	0.000	0.000	0.537	3.660
1992	0.246	0.467	0.749	1.222	1.392	2.687	2.302	4.456	0.000	0.000	0.000	0.595	4.456
1993	0.264	0.482	0.700	1.476	1.671	1.865	2.816	4.136	5.199	0.000	0.000	0.572	4.490
1994	0.345	0.523	0.629	1.354	2.093	2.742	3.399		3.703	0.000	0.000	0.606	3.703
1995	0.376	0.527	0.678	1.054	1.637	2.627	3.624	4.094	0.000	0.000	0.000	0.675	4.094
1996	0.329	0.503	0.569	1.077	1.549	1.963	2.569	3.200	3.394	4.510	0.000	0.621	3.578
1997	0.215	0.450	0.638	0.866	1.233	2.252	2.573	3.429	0.000	0.000	0.000	0.695	3.429
1998	0.259	0.522	0.653	0.859	1.321	2.410	2.588	3.983	0.000	0.000	0.000	0.764	3.983
1999	0.143	0.372	0.593	0.895	1.439	1.998	2.716	3.495	3.904	0.000	0.000	0.753	3.498
2000	0.066	0.584	0.806	1.082	1.785	2.721	2.598	2.730	3.358	3.357	3.707	1.010	2.959
2001	0.114	0.542	0.765	0.968	1.449	2.145	2.598	3.461	3.914	3.806	5.499	0.900	3.651
2002	0.205	0.481	0.739	0.954	1.373	2.101	2.666	3.728	4.232	2.983	0.000	0.902	3.742
2003	0.170	0.499	0.761	1.030	1.527	2.072	2.764	3.175	3.569	3.560	4.964	1.002	3.285
2004	0.328	0.516	0.737	0.969	1.350	1.757	2.357	3.024	3.176	3.670	3.892	0.983	3.106
2005	0.208	0.433	0.690	0.932	1.193	1.508	1.895	2.155	2.297	3.111	3.369	0.954	2.336
2006	0.156	0.454	0.682	0.961	1.264	1.645	2.184	2.943	3.119	3.898	2.631	0.950	3.020
2007	0.169	0.388	0.683	0.949	1.276	1.694	2.119	2.540	3.062	3.372	3.346	0.996	2.767
2008	0.184	0.379	0.605	0.881	1.170	1.560	1.902	2.253	2.621	3.217	3.114	1.065	2.460
2009	0.167	0.350	0.612	0.846	1.078	1.470	1.885	2.425	2.500	3.265	3.825	0.958	2.547
2010	0.169	0.325	0.531	0.773	1.053	1.396	1.864	2.268	2.732	3.259	3.682	0.941	2.668
2011	0.177	0.332	0.521	0.693	1.001	1.496	1.845	2.157	2.597	2.842	3.448	0.988	2.398

Table 34. Commercial and recreational fishery landings, estimated discard, and total catch statistics (metric tons) as used in the assessment of summer flounder, Maine to North Carolina. Includes Marine Recreational Fisheries Statistics Survey (MRFSS) estimates of recreational catch.

	Commercial			Recreational			Total		
Year	Landings	Discard	Catch	Landings	Discard	Catch	Landings	Discard	Catch
1982	10,400	n/a	10,400	8,267	296	8,563	18,667	296	18,963
1983	13,403	n/a	13,403	12,687	376	13,063	26,090	376	26,466
1984	17,130	n/a	17,130	8,512	415	8,927	25,642	415	26,057
1985	14,675	n/a	14,675	5,665	92	5,757	20,340	92	20,432
1986	12,186	n/a	12,186	8,102	578	8,680	20,288	578	20,866
1987	12,271	n/a	12,271	5,519	522	6,041	17,790	522	18,312
1988	14,686	n/a	14,686	6,634	341	6,975	21,320	341	21,661
1989	8,125	709	8,834	1,435	45	1,480	9,560	754	10,314
1990	4,199	1,214	5,413	2,329	234	2,563	6,528	1,448	7,976
1991	6,224	1,052	7,276	3,611	429	4,040	9,835	1,481	11,316
1992	7,529	690	8,219	3,242	344	3,586	10,771	1,034	11,805
1993	5,715	846	6,561	4,006	910	4,916	9,721	1,756	11,477
1994	6,588	906	7,494	4,231	687	4,918	10,819	1,593	12,412
1995	6,977	308	7,285	2,459	752	3,211	9,436	1,060	10,496
1996	5,861	463	6,324	4,454	681	5,135	10,315	1,144	11,459
1997	3,994	326	4,320	5,382	556	5,938	9,376	882	10,258
1998	5,076	389	5,465	5,659	734	6,393	10,735	1,123	11,858
1999	4,820	1,548	6,368	3,795	711	4,506	8,615	2,259	10,874
2000	5,085	726	5,811	7,470	952	8,422	12,555	1,678	14,233
2001	4,970	468	5,438	5,279	1,274	6,553	10,249	1,742	11,991
2002	6,573	449	7,022	3,632	777	4,409	10,205	1,226	11,431
2003	6,450	528	6,978	5,279	882	6,161	11,729	1,410	13,139
2004	8,228	244	8,472	4,831	1,034	5,865	13,059	1,278	14,337
2005	7,826	230	8,056	4,724	999	5,723	12,550	1,229	13,779
2006	6,262	288	6,550	4,992	795	5,787	11,254	1,083	12,337
2007	4,489	304	4,793	4,445	1,130	5,575	8,934	1,434	10,368
2008	4,143	309	4,452	3,584	1,251	4,835	7,727	1,560	9,287
2009	4,848	118	4,966	2,856	1,195	4,051	7,704	1,313	9,017
2010	5,930	198	6,128	2,238	1,079	3,179	8,168	1,277	9,445
2011	7,511	126	7,637	2,543	1,074	3,598	10,054	1,200	11,254

Table 35. Commercial and recreational fishery landings, estimated discard, and total catch statistics (metric tons) as used in the assessment of summer flounder, Maine to North Carolina. Includes Marine Recreational Information Program (MRIP) 2004-2011 estimates of recreational catch, and 1982-2003 recreational catch adjusted by the 2004-2011 MRIP to Marine Recreational Fisheries Statistics Survey ratio for each catch type.

	Commercial			Recreational			Total		
Year	Landings	Discard	Catch	Landings	Discard	Catch	Landings	Discard	Catch
1982	10,400	n/a	10,400	8163	284	8,447	18,563	284	18,847
1983	13,403	n/a	13,403	12527	361	12,889	25,930	361	26,292
1984	17,130	n/a	17,130	8405	399	8,804	25,535	399	25,934
1985	14,675	n/a	14,675	5594	88	5,682	20,269	88	20,357
1986	12,186	n/a	12,186	8000	555	8,555	20,186	555	20,741
1987	12,271	n/a	12,271	5450	502	5,951	17,721	502	18,222
1988	14,686	n/a	14,686	6550	328	6,878	21,236	328	21,564
1989	8,125	709	8,834	1417	43	1,460	9,542	752	10,294
1990	4,199	1,214	5,413	2300	225	2,525	6,499	1,439	7,938
1991	6,224	1,052	7,276	3566	412	3,978	9,790	1,464	11,254
1992	7,529	690	8,219	3201	331	3,532	10,730	1,021	11,751
1993	5,715	846	6,561	3956	874	4,830	9,671	1,720	11,391
1994	6,588	906	7,494	4178	660	4,838	10,766	1,566	12,332
1995	6,977	308	7,285	2428	723	3,152	9,405	1,031	10,437
1996	5,861	463	6,324	4398	654	5,052	10,259	1,117	11,376
1997	3,994	326	4,320	5314	534	5,848	9,308	860	10,168
1998	5,076	389	5,465	5588	705	6,293	10,664	1,094	11,758
1999	4,820	1,548	6,368	3747	683	4,430	8,567	2,231	10,798
2000	5,085	726	5,811	7376	915	8,291	12,461	1,641	14,102
2001	4,970	468	5,438	5213	1224	6,437	10,183	1,692	11,875
2002	6,573	449	7,022	3586	747	4,333	10,159	1,196	11,355
2003	6,450	528	6,978	5213	847	6,060	11,663	1,375	13,038
2004	8,228	244	8,472	4974	1017	5,991	13,202	1,261	14,463
2005	7,826	230	8,056	4929	954	5,883	12,755	1,184	13,939
2006	6,262	288	6,550	4804	771	5,575	11,066	1,059	12,125
2007	4,489	304	4,793	4199	1007	5,206	8,688	1,311	9,999
2008	4,143	309	4,452	3689	1158	4,847	7,832	1,467	9,299
2009	4,848	118	4,966	2716	1142	3,858	7,564	1,260	8,824
2010	5,930	198	6,128	2317	1069	3,387	8,247	1,267	9,515
2011	7,511	126	7,637	2645	1096	3,741	10,156	1,222	11,378

Table 36. Northeast Fisheries Science Center (NEFSC) research trawl survey indices of abundance for summer flounder. Indices are stratified mean numbers (n) and weight (kg) per tow. Spring indices are for offshore strata 1-12 61-76; fall indices are for offshore strata 1-2, 5-6, 9-10, 61, 65, 69, and 73. Winter indices (1992-2007) are for NEFSC offshore strata 1-3, 5-7, 9-11, 13-14, 16-17, 61-63, 65-67, 69-71, and 73-75. n/a = not available due to incomplete coverage (spring) or end of survey (winter). Note that door and vessel conversion factors for 1967-2008 are not significant; 1967-2008 gear conversion factors have not been included due to limited sample size and extreme violation of underlying assumptions in experimental work.

Year	Spring (n)	Spring (kg)	Fall (n)	Fall (kg)
1967	n/a	n/a	1.35	1.25
1968	0.15	0.16	1.10	1.00
1969	0.19	0.16	0.59	0.61
1970	0.09	0.09	0.15	0.13
1971	0.22	0.28	0.42	0.27
1972	0.47	0.21	0.39	0.27
1973	0.76	0.54	0.87	0.63
1974	1.37	1.26	1.70	1.86
1975	1.97	1.61	3.00	2.48
1976	2.83	2.00	1.14	0.85
1977	2.84	1.74	2.17	1.75
1978	2.55	1.40	0.32	0.40
1979	0.40	0.35	1.17	0.94
1980	1.30	0.78	0.94	0.57
1981	1.50	0.80	0.91	0.72
1982	2.27	1.11	1.57	0.90
1983	0.95	0.53	0.90	0.47
1984	0.66	0.38	0.99	0.65
1985	2.38	1.20	1.24	0.87
1986	2.14	0.82	0.68	0.45
1987	0.93	0.38	0.26	0.28
1988	1.50	0.68	0.11	0.11
1989	0.32	0.24	0.20	0.08
1990	0.72	0.27	0.27	0.19
1991	1.08	0.35	0.51	0.17

Table 36, continued. Northeaset Fisheries Science Center (NEFSC) research trawl survey indices of abundance for summer flounder. Indices are stratified mean numbers (n) and weight (kg) per tow. Spring indices are for offshore strata 1-12 61-76; fall indices are for offshore strata 1-2, 5-6, 9-10, 61, 65, 69, and 73. Winter indices (1992-2007) are for NEFSC offshore strata 1-3, 5-7, 9-11, 13-14, 16-17, 61-63, 65-67, 69-71, and 73-75. n/a = not available due to incomplete coverage (spring) or end of survey (winter). Note that door and vessel conversion factors for 1967-2008 are not significant; 1967-2008 gear conversion factors have not been included due to limited sample size and extreme violation of underlying assumptions in experimental work.

Year	Winter (n)	Winter (kg)	Spring (n)	Spring (kg)	Fall (n)	Fall (kg)
1992	12.30	4.90	1.20	0.46	0.85	0.49
1993	13.60	5.50	1.27	0.48	0.11	0.04
1994	12.05	6.03	0.93	0.46	0.60	0.35
1995	10.93	4.81	1.09	0.46	1.13	0.83
1996	31.25	12.35	1.76	0.67	0.71	0.45
1997	10.28	5.54	1.06	0.61	1.32	0.92
1998	7.76	5.13	1.19	0.76	2.32	1.58
1999	11.06	7.99	1.60	1.01	2.42	1.66
2000	15.76	12.59	2.14	1.70	1.90	1.82
2001	18.59	15.68	2.69	2.16	1.56	1.55
2002	22.68	18.43	2.47	2.29	1.32	1.40
2003	35.62	27.48	2.91	2.42	2.00	1.93
2004	17.77	15.25	3.03	2.43	3.00	3.06
2005	12.89	10.32	1.81	1.59	1.57	1.83
2006	21.04	15.93	1.77	1.34	2.10	1.79
2007	16.83	12.89	3.25	3.17	2.21	2.45
2008	n/a	n/a	1.40	1.38	1.38	1.62

Table 37. Northeast Fisheries Science Center (NEFSC) research trawl spring and fall survey indices from the FSV *Henry B. Bigelow* (HBB) and calibrated, equivalent indices for the FSV *Albatross IV* (ALB) time series. Indices are stratified mean numbers (n) and weight (kg) per tow. Spring indices are for offshore strata 1-12, 61-76; fall indices are for offshore strata 1-2, 5-6, 9-10, 61, 65, 69, and 73. The aggregate spring catch number calibration factor is 3.2255; the spring catch weight factor is 3.0657; the fall catch number factor is 2.4054; the fall catch weight factor is 2.1409.

Year	Spring (n) HBB	Spring (kg) HBB	Spring (n) ALB	Spring (kg) ALB
2009	5.672	3.598	1.758	1.174
2010	7.131	4.808	2.211	1.568
2011	8.174	4.929	2.534	1.608
2012	6.612	5.007	1.062	1.633

Year	Fall (n) HBB	Fall (kg) HBB	Fall (n) ALB	Fall (kg) ALB
2009	7.062	5.622	2.936	2.626
2010	3.466	2.941	1.441	1.374
2011	5.663	5.751	2.354	2.686

Table 38. Northeast Fisheries Science Center (NEFSC) trawl survey spring and fall survey indices from the FSV Henry B. Bigelow (HBB) and length calibrated, equivalent indices for the FSV Albatross IV (ALB) time series. Indices are the sum of the stratified mean numbers (n) at length. Spring strata set includes offshore strata 1-12, 61-76. Fall strata set (aged set) includes offshore strata 1, 5, 9, 61, 65, 69, 73, and inshore strata 1-61. The HBB does not sample the shallowest inshore strata (0-18 m, 0-60 ft, 0-10 fathoms). The length calibration factors are for the lengths observed in the 2008 calibration experiment and include a constant swept area factor of 0.579. The effective total catch number calibration factors (HBB/ALB ratios) vary by year and season, depending on the characteristics of the HBB length frequency distributions.

Year	Spring (n) HBB	HBB CV	Spring (n) ALB	Effective Factor
2009	5.672	12.1	2.845	1.994
2010	7.131	10.9	3.772	1.891
2011	8.174	15.9	4.448	1.838
2012	6.612	13.9	3.623	1.825

Year	Fall (n) HBB	HBB CV	Fall (n) ALB	Effective Factor
2009	9.509	19.4	5.128	1.854
2010	4.876	16.9	2.688	1.814
2011	7.385	22.1	3.945	1.872

Table 39. NEFSC trawl survey spring and fall survey indices at age from the FSV Henry B. Bigelow (HBB) and equivalent indices at age for the FSV Albatross IV (ALB) time series. The spring strata set includes offshore strata 1-12, 61-76. The fall strata set (aged set) includes offshore strata 1, 5, 9, 61, 65, 69, 73, and inshore strata 1-61. Indices at age are compiled after the application of length calibration factors including a constant swept area factor of 0.579. The effective catch number at age calibration factors (HBB/ALB ratios) vary by year and season, depending on the characteristics of the HBB length frequency distributions.

Spring									
2009	0	1	2	3	4	5	6	7+	Total
HBB	0.00	1.76	1.54	1.15	0.61	0.41	0.11	0.11	5.67
ALB	0.00	0.72	0.89	0.63	0.32	0.20	0.05	0.04	2.85
HBB/ALB	0.00	2.44	1.73	1.83	1.91	2.05	2.20	2.75	1.99
2010	0	1	2	3	4	5	6	7+	Total
HBB	0.00	1.95	1.87	1.51	0.93	0.47	0.19	0.22	7.13
ALB	0.00	0.95	1.09	0.83	0.49	0.24	0.09	0.08	3.77
HBB/ALB	0.00	2.05	1.72	1.82	1.90	1.96	2.11	2.75	1.89
2011	0	1	2	3	4	5	6	7+	Total
HBB	0.00	1.48	2.44	2.18	1.06	0.63	0.16	0.22	8.17
ALB	0.00	0.72	1.43	1.25	0.56	0.32	0.08	0.09	4.45
HBB/ALB	0.00	2.06	1.71	1.74	1.89	1.97	2.00	2.44	1.84
Fall									
2009	0	1	2	3	4	5	6	7+	Total
HBB	0.64	3.41	2.27	1.52	0.94	0.42	0.13	0.18	9.51
ALB	0.27	1.97	1.27	0.81	0.48	0.21	0.05	0.06	5.13
HBB/ALB	2.37	1.73	1.79	1.88	1.96	2.00	2.60	3.00	1.85
2010	0	1	2	3	4	5	6	7+	Total
HBB	0.23	1.66	1.28	0.78	0.46	0.27	0.11	0.09	4.88
ALB	0.10	0.96	0.74	0.43	0.24	0.13	0.05	0.04	2.69
HBB/ALB	2.30	1.73	1.73	1.81	1.92	2.08	2.20	2.25	1.81
2011	0	1	2	3	4	5	6	7+	Total
HBB	0.33	1.74	1.99	1.30	0.65	0.48	0.31	0.59	7.39
ALB	0.15	1.01	1.14	0.71	0.33	0.23	0.15	0.23	3.95
HBB/ALB	2.20	1.72	1.75	1.83	1.97	2.09	2.07	2.57	1.87

Table 40. Northeast Fisheries Science Center (NEFSC) spring trawl survey (offshore strata 1-12, 61-76) stratified mean number of summer flounder per tow at age.

	Age										
Year	1	2	3	4	5	6	7	8	9	10+	ALL
1976	0.03	1.77	0.71	0.29	0.01	0.01	0.01				2.83
1977	0.61	1.31	0.71	0.10	0.09	0.01		0.01			2.84
1978	0.68	0.93	0.64	0.19	0.04	0.03	0.03			0.01	2.55
1979	0.06	0.18	0.08	0.04	0.03			0.01			0.40
1980	0.01	0.70	0.31	0.14	0.02	0.06	0.03	0.02		0.01	1.30
1981	0.60	0.54	0.17	0.08	0.05	0.03	0.02	0.01			1.50
1982	0.70	1.43	0.12	0.02							2.27
1983	0.32	0.39	0.19	0.03	0.01				0.01		0.95
1984	0.17	0.33	0.09	0.05		0.01	0.01				0.66
1985	0.55	1.56	0.21	0.04	0.02						2.38
1986	1.48	0.43	0.20	0.02	0.01						2.14
1987	0.47	0.43	0.02	0.01							0.93
1988	0.60	0.81	0.07	0.02							1.50
1989	0.06	0.23	0.02	0.01							0.32
1990	0.63	0.03	0.06								0.72
1991	0.79	0.27		0.02							1.08
1992	0.77	0.41	0.01		0.01						1.20
1993	0.73	0.50	0.04								1.27
1994	0.35	0.53	0.04	0.01							0.93
1995	0.79	0.27	0.02				0.01				1.09
1996	1.08	0.56	0.12								1.76
1997	0.29	0.67	0.09	0.01							1.06
1998	0.27	0.52	0.32	0.06	0.01	0.01					1.19
1999	0.22	0.74	0.48	0.13	0.02	0.01					1.60
2000	0.19	1.03	0.63	0.12	0.15	0.02					2.14
2001	0.48	0.89	1.02	0.20	0.05	0.04	0.01				2.69
2002	0.34	0.89	0.74	0.31	0.10	0.03	0.05	0.01			2.47
2003	0.54	1.29	0.59	0.29	0.13	0.06	0.01	0.01			2.91
2004	0.30	1.45	0.85	0.27	0.05	0.06	0.04				3.03
2005	0.26	0.65	0.58	0.15	0.10	0.05	0.02		<.0.1		1.81
2006	0.04	1.04	0.24	0.25	0.09	0.06	0.02	0.01		0.02	1.77
2007	0.24	0.52	1.46	0.57	0.18	0.13	0.07	0.04	0.01	0.03	3.25
2008	0.22	0.35	0.32	0.29	0.11	0.09	0.02				1.40
2009	0.72	0.89	0.63	0.32	0.20	0.05	0.02	0.01	0.01	<0.01	2.85
2010	0.95	1.09	0.83	0.49	0.24	0.09	0.05	0.02	0.01	<0.01	3.77
2011	0.72	1.43	1.25	0.56	0.32	0.08	0.04	0.03	0.01	0.01	4.45

Table 41. Northeast Fisheries Science Center (NEFSC) spring trawl survey (offshore strata 1-12, 61-76) summer flounder mean length (cm) at age.

	Age											
Year	1	2	3	4	5	6	7	8	9	10	11	12
1976	25.9	36.0	43.1	53.5	60.8	70.0	72.0					
1977	25.2	35.0	43.4	51.7	59.6	63.0		74.0				
1978	27.3	34.8	40.9	46.9	53.3	59.5	64.0				65.0	75.0
1979	25.1	37.0	43.2	51.5	54.8			77.0				
1980	29.0	28.8	38.1	44.2	51.1	53.0	67.7	77.0		81.0		
1981	25.3	32.2	39.8	48.9	55.7	62.9	67.8	74.0				
1982	28.6	36.2	47.3	46.7								
1983	25.5	37.7	43.4	53.3	61.4				77.0			
1984	27.1	33.9	41.8	56.7		63.0	56.0					
1985	26.8	36.1	42.8	57.2	54.5							
1986	28.6	36.3	46.0	56.0	63.0							
1987	27.8	37.7	47.3	58.0								
1988	27.7	36.3	47.8	45.0								
1989	30.4	39.2	51.5	60.0								
1990	28.3	47.7	48.6									
1991	27.0	38.8		42.1								
1992	27.9	37.7	57.0		72.0							
1993	27.5	37.9	51.9									
1994	33.0	36.8	48.0	53.1								
1995	29.4	40.0	46.4				72.0					
1996	29.8	36.2	47.2									
1997	29.4	38.3	49.4	54.1								
1998	27.6	39.1	42.7	50.5	50.0	60.0						
1999	28.5	35.8	42.9	49.1	57.7	64.0						
2000	29.5	37.9	44.3	49.4	55.4	60.5						
2001	29.6	39.1	44.9	53.4	60.5	63.8	55.0					
2002	29.7	39.3	45.8	52.7	58.1	63.5	62.1	66.0	54.0	68.0		
2003	32.4	39.3	46.5	51.4	57.5	65.2	51.0	65.0				
2004	29.5	37.6	46.1	50.4	56.9	61.9	63.3					
2005	29.2	39.1	45.1	50.9	55.0	58.3	71.3				73.0	
2006	28.3	36.3	42.1	47.6	51.8	54.0	57.0	63.0		62.0	66.0	
2007	28.3	38.7	43.0	48.2	55.2	53.9	60.4	65.6	61.0	69.4		63.0
2008	32.0	37.3	45.1	49.0	55.9	59.6	57.9					
2009	25.9	36.7	41.3	46.2	52.6	59.9	62.4	63.6	68.2	67.0		
2010	28.4	35.2	41.1	45.5	50.7	56.9	60.5	64.4	65.7	69.5	73.0	68.0
2011	28.3	33.9	37.9	43.6	49.4	56.5	55.7	58.3	64.5	60.4	82.0	

Table 42. Northeast (NEFSC) fall trawl survey (offshore strata <= 55 m (1, 5, 9, 61, 65, 69, 73), inshore strata 1-61) mean number of summer flounder per tow at age.

	Age								
Year	0	1	2	3	4	5	6	7+	ALL
1982	0.55	1.52	0.40	0.03					2.50
1983	0.96	1.46	0.34	0.12	0.01	0.01			2.90
1984	0.18	1.39	0.43	0.07	0.01	0.01	<0.01		2.09
1985	0.59	0.80	0.46	0.05		0.02			1.92
1986	0.39	0.83	0.11	0.11		<0.01			1.44
1987	0.07	0.58	0.20	0.03	0.02				0.90
1988	0.06	0.62	0.18	0.03					0.89
1989	0.31	0.21	0.05						0.57
1990	0.44	0.38	0.03	0.04		<0.01			0.89
1991	0.76	0.84	0.09		0.01	<0.01	<0.01		1.70
1992	0.99	1.04	0.25	0.03	0.01	<0.01			2.32
1993	0.23	0.80	0.03	0.01			<0.01		1.07
1994	0.75	0.67	0.09	0.01	0.01				1.53
1995	0.93	1.16	0.28	0.02	0.01				2.40
1996	0.11	1.24	0.57	0.04					1.96
1997	0.17	1.29	1.14	0.29	0.02	0.01	0.01	<0.01	2.93
1998	0.38	2.13	1.63	0.33	0.04	0.01			4.52
1999	0.21	1.73	1.49	0.31	0.04	0.01			3.79
2000	0.22	1.20	1.22	0.40	0.15	0.06	0.03	0.04	3.32
2001	0.12	1.36	0.93	0.37	0.11	0.10		0.01	3.00
2002	0.06	1.17	0.86	0.35	0.11	0.03	0.03	0.02	2.63
2003	0.18	1.31	1.03	0.25	0.10	0.03	0.07	0.01	2.98
2004	0.36	1.49	1.37	0.66	0.19	0.07	0.06	0.04	4.24
2005	0.16	1.14	0.54	0.47	0.18	0.10	0.13	0.03	2.75
2006	0.31	0.72	1.22	0.35	0.17	0.06	0.07	0.02	2.91
2007	0.12	0.84	0.91	0.96	0.31	0.09	0.09	0.04	3.36
2008	0.39	0.52	0.59	0.33	0.46	0.16	0.10	0.09	2.64
2009	0.27	1.97	1.27	0.81	0.48	0.21	0.05	0.06	5.13
2010	0.10	0.96	0.74	0.43	0.24	0.13	0.05	0.04	2.69
2011	0.15	1.01	1.14	0.71	0.33	0.23	0.14	0.23	3.94

Table 43. Northeast Fisheries Science Center (NEFSC) fall trawl survey (offshore strata <= 55 m (1, 5, 9, 61, 65, 69, 73), inshore strata 1-61) summer flounder mean length (cm) at age.

	Age							
Year	0	1	2	3	4	5	6	7+
1982	28.2	35.1	43.3	47.1				
1983	24.5	33.5	42.7	52.3	60.0	58.0		
1984	23.5	33.6	41.1	46.5	62.6	65.0	70.0	
1985	25.5	35.4	43.1	53.0		63.0		
1986	23.1	35.7	40.8	53.5		57.0		
1987	27.4	34.4	46.0	53.6	47.7			
1988	30.1	35.9	43.4	61.7				
1989	25.8	35.8	48.2	60.0				
1990	24.8	36.0	45.2	54.9	60.0	68.0		
1991	23.2	34.7	43.7	59.0	61.2	67.0	69.0	
1992	25.3	34.4	42.7	51.3	58.8	68.0		
1993	29.9	35.1	44.0	58.1	59.0		70.0	
1994	27.5	38.0	44.3	61.5	57.0			
1995	26.5	36.7	47.4	59.0	65.0			
1996	26.6	35.4	41.6	56.1				
1997	28.4	35.1	40.3	46.5	51.7	59.3	56.0	63.0
1998	24.0	34.7	42.6	50.2	58.2	68.6		
1999	24.1	34.7	40.0	48.5	55.6	56.8		
2000	25.2	35.7	42.1	48.6	53.5	59.9	68.0	66.5
2001	21.8	36.3	42.6	50.0	54.0	62.1		67.0
2002	25.4	36.8	43.8	49.5	55.3	61.4	67.9	69.9
2003	23.2	37.0	43.4	51.8	56.8	59.5	58.5	72.0
2004	23.9	36.8	43.5	48.4	56.2	59.4	60.7	71.2
2005	28.8	34.2	42.2	47.5	51.6	56.4	63.5	63.8
2006	21.5	35.9	41.1	48.1	52.9	55.2	57.6	63.5
2007	22.7	34.2	41.9	46.4	52.4	55.1	58.7	71.0
2008	21.5	35.0	40.4	44.9	48.3	50.9	57.3	63.8
2009	27.7	33.3	39.6	44.2	49.7	53.3	59.2	67.7
2010	28.1	33.0	36.8	41.4	46.9	52.9	57.9	62.8
2011	28.5	33.6	37.3	41.7	47.6	53.2	54.9	59.1

Table 44. Northeast Fisheries Science Center (NEFSC) winter trawl survey (offshore strata from 27-185 meters (15-100 fathoms) 1-3, 5-7, 9-11, 13-14, 16-17, 61-63, 65-67, 69-71, 73-75; Southern Georges Bank to Cape Hatteras): mean number and mean weight (kg) per tow. The winter survey ended in 2007.

Year	Stratified mean number per tow	Coefficient of variation	Stratified mean weight (kg) per tow	Coefficient of variation
1992	12.30	15.6	4.90	15.4
1993	13.60	15.2	5.50	11.9
1994	12.05	17.8	6.03	16.1
1995	10.93	12.0	4.81	11.6
1996	31.25	24.2	12.35	22.0
1997	10.28	24.0	5.54	16.6
1998	7.76	20.7	5.13	16.6
1999	11.06	13.3	7.99	11.4
2000	15.76	13.0	12.59	12.8
2001	18.59	11.4	15.68	13.2
2002	22.55	15.6	18.71	15.7
2003	35.62	18.7	27.48	19.1
2004	17.77	13.9	15.25	14.6
2005	12.89	14.6	10.32	20.0
2006	21.04	13.9	15.93	13.6
2007	16.83	12.8	12.89	14.7

Table 45. Northeast Fisheries Science Center (NEFSC winter trawl survey (offshore strata from 27-185 meters (15-100 fathoms) 1-3, 5-7, 9-11, 13-14, 16-17, 61-63, 65-67, 69-71, 73-75; Southern Georges Bank to Cape Hatteras): mean number at age per tow. The winter survey ended in 2007.

Year	Age												
	1	2	3	4	5	6	7	8	9	10	11	12+	Total
1992	7.15	4.74	0.33	0.04	0.01	0.03							12.29
1993	6.50	6.70	0.31	0.05	0.02	0.02							13.60
1994	3.76	7.20	0.82	0.26			0.01						12.05
1995	6.07	4.59	0.25	0.02									10.93
1996	22.17	8.33	0.60	0.12	0.03								31.25
1997	3.86	4.80	1.04	0.43	0.11	0.04							10.28
1998	1.68	3.25	2.29	0.42	0.10	0.01				0.01			7.76
1999	2.11	4.80	2.90	0.84	0.28	0.06	0.04	0.02		0.01			11.06
2000	0.70	6.52	4.96	2.51	0.78	0.17	0.08	0.04	0.01				15.76
2001	3.07	5.33	6.42	2.44	0.80	0.37	0.09	0.05	0.01		0.01	0.01	18.59
2002	2.77	10.74	5.58	2.26	0.85	0.32	0.13	0.02	0.01				22.68
2003	8.17	14.36	8.48	2.67	1.04	0.39	0.32	0.15	0.05		0.01		35.62
2004	1.45	8.68	4.56	1.64	0.62	0.41	0.19	0.16	0.02	0.03	0.01		17.77
2005	2.96	4.03	3.07	1.34	0.70	0.33	0.17	0.13	0.12	0.03		0.01	12.89
2006	2.64	9.06	4.29	2.47	1.32	0.56	0.24	0.22	0.14	0.07	0.01	0.04	21.04
2007	2.77	6.18	5.15	1.54	0.58	0.31	0.16	0.05	0.08	0.01			16.83

Table 46. Northeast Fisheries Science Center (NEFSC) winter trawl survey (offshore strata from 27-185 meters (15-100 fathoms) 1-3, 5-7, 9-11, 13-14, 16-17, 61-63, 65-67, 69-71, 73-75; Southern Georges Bank to Cape Hatteras): summer flounder mean length (cm) at age. The winter survey ended in 2007.

	Age											
Year	1	2	3	4	5	6	7	8	9	10	11	12+
1992	28.0	38.4	48.8	60.0	70.0	69.0						
1993	27.9	37.3	49.4	58.7	58.5	65.0						
1994	28.0	37.5	46.1	56.4			69.0					
1995	27.4	40.2	50.8	59.6								
1996	30.9	38.2	51.4	61.2	63.6							
1997	29.2	37.8	44.5	50.0	57.3	62.5						
1998	28.4	38.0	43.3	52.2	59.7	66.3				64.0		
1999	28.4	36.9	44.5	51.6	59.2	64.1	70.2	68.8		78.0		
2000	28.2	35.9	41.4	49.0	56.3	62.2	68.2	67.1	77.0			
2001	28.3	37.3	43.6	50.2	56.3	61.0	65.3	69.4	58.6		70.0	74.0
2002	30.0	38.5	44.5	51.4	58.1	62.2	66.4	62.7	75.0			
2003	30.8	39.2	45.2	51.4	55.9	61.0	65.6	67.8	67.1		67.0	
2004	28.8	38.6	44.5	50.8	55.0	60.2	65.0	66.6	67.1	72.4	69.0	
2005	27.7	37.6	44.1	48.9	53.3	56.4	60.8	64.1	65.3	70.6		71.5
2006	30.9	36.8	41.0	46.7	51.2	54.6	60.2	61.4	62.1	68.2	65.0	73.3
2007	27.8	38.2	43.5	49.1	53.8	57.3	62.1	63.6	66.0	65.0		

Table 47. Massachusetts Division of Marine Fisheries spring survey cruises: stratified mean number per tow at age.

	Age								
Year	0	1	2	3	4	5	6	7	8+	Total
1978		0.102	0.547	0.288	0.232		0.045			1.214
1979			0.087	0.090	0.152	0.050	0.011			0.390
1980		0.056	0.062	0.053	0.077	0.054	0.056	0.012		0.370
1981		0.431	0.593	0.079	0.033	0.046	0.064		0.032	1.278
1982		0.350	1.584	0.142	0.042	0.022			0.010	2.150
1983		0.051	0.599	0.450	0.024	0.009	0.022		0.012	1.167
1984		0.044	0.078	0.067	0.116					0.305
1985		0.154	1.260	0.036	0.051	0.004				1.505
1986		0.995	0.522	0.185	0.009					1.711
1987		0.656	0.640	0.013			0.011			1.320
1988		0.211	1.005	0.123	0.014					1.353
1989			0.363	0.102			0.011			0.476
1990		0.257	0.021	0.081	0.013					0.372
1991		0.032	0.050	0.011						0.093
1992		0.280	0.342	0.090		0.012	0.011			0.735
1993		0.126	0.492	0.065	0.010				0.022	0.715
1994		1.860	1.217	0.048	0.023		0.011			3.159
1995		0.104	1.302	0.053						1.459
1996		0.076	0.686	0.114	0.012					0.888
1997		0.544	1.279	0.181	0.116		0.006			2.126
1998		0.144	1.212	0.659	0.049	0.050				2.114
1999		0.078	0.878	1.112	0.302	0.029		0.016		2.415
2000		0.237	1.659	1.205	0.305	0.232	0.054			3.692
2001		0.186	1.026	0.730	0.229	0.057				2.228
2002		0.151	1.511	0.397	0.102	0.066	0.026	0.014	0.019	2.286
2003		0.206	1.440	0.624	0.185	0.118	0.012	0.023		2.608
2004		0.027	0.283	0.323	0.061	0.061	0.026	0.023	0.010	0.814
2005		0.136	0.351	1.029	0.315	0.132	0.074	0.053	0.107	2.197
2006		0.049	2.440	0.975	0.229	0.070	0.086	0.020	0.021	3.890
2007		0.254	0.392	1.008	0.102	0.080	0.051	0.012		1.899
2008		0.328	0.383	0.167	0.309	0.061	0.016	0.066	0.018	1.348
2009		0.251	0.847	0.613	0.146	0.168	0.035	0.040	0.036	2.135
2010		0.983	0.670	0.651	0.415	0.043	0.062		0.011	2.835
2011		0.150	0.986	0.753	0.144	0.111	0.006			2.148

Table 48. Massachusetts Division of Marine Fisheries fall survey cruises: stratified mean number per tow at age.

	Age									
Year	0	1	2	3	4	5	6	7	8+	Total
1978		0.039	0.442	0.085		0.025				0.591
1979			0.050	0.109		0.020				0.179
1980		0.123	0.351	0.022	0.022	0.009				0.527
1981	0.010	0.400	0.405	0.012						0.827
1982	0.038	0.234	1.662	0.019						1.953
1983		0.033	0.625	0.154	0.006					0.818
1984	0.033	0.485	0.267	0.127		0.011				0.923
1985	0.057	0.117	1.895	0.039						2.108
1986	0.145	2.316	0.679	0.214	0.008	0.003				3.365
1987		1.202	0.663	0.011	0.006					1.882
1988		0.474	0.429	0.006	0.007	0.006				0.922
1989			0.317	0.016			0.012			0.345
1990		0.113		0.011						0.124
1991	0.024	0.531	0.288	0.005						0.848
1992		1.181	0.186							1.367
1993	0.009	0.335	0.478	0.030	0.022					0.874
1994	0.052	2.234	0.077							2.363
1995	0.011	0.342	0.507							0.860
1996		0.761	1.282	0.114	0.006					2.163
1997		0.494	1.508	0.351	0.020	0.036				2.409
1998		0.012	0.590	0.262	0.018	0.011				0.893
1999	0.061	0.347	0.940	0.379	0.037					1.764
2000	0.074	1.383	2.303	0.494	0.100	0.092	0.014	0.028		4.488
2001	0.011	1.244	1.083	0.307	0.027		0.011	0.017		2.700
2002	0.325	2.681	1.302	0.178	0.047	0.036				4.569
2003	0.133	3.059	1.254	0.256	0.037	0.028	0.006		0.010	4.783
2004	0.026	0.589	1.455	0.136	0.011	0.010				2.227
2005		1.557	2.049	1.350	0.446	0.096	0.015	0.015	0.017	5.545
2006	0.336	0.586	3.745	0.559	0.043	0.023	0.016			5.308
2007	0.399	0.500	0.401	1.039	0.168	0.067	0.016			2.590
2008	0.257	1.341	1.238	0.142	0.241	0.045				3.264
2009	0.320	0.362	0.784	0.551	0.172	0.126	0.050		0.019	2.383
2010	0.078	2.357	0.738	0.459	0.151	0.029	0.031			3.843
2011		0.394	1.876	2.200	0.235	0.074	0.011		0.026	4.816

Table 49. Massachusetts Division of Marine Fisheries seine survey: total catch of age-0 summer flounder.

Year	Total catch
1982	3
1983	3
1984	1
1985	19
1986	5
1987	4
1988	2
1989	4
1990	11
1991	4
1992	0
1993	2
1994	1
1995	14
1996	7
1997	0
1998	13
1999	13
2000	10
2001	1
2002	70
2003	11
2004	4
2005	1
2006	43
2007	38
2008	86
2009	45
2010	4
2011	1

Table 50. Rhode Island Department of Fish and Wildlife (RIDFW) fall trawl survey summer flounder index of abundance. RIDFW lengths aged with Northeast Fisheries Science Center (NEFSC) fall trawl survey age-length keys.

Year	Age										
	0	1	2	3	4	5	6	7	8	9+	Total
1981	0.30	0.97	1.74	0.20	0.01	0.00	0.00	0.00	0.00	0.00	3.24
1982	0.02	0.21	0.52	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.83
1983	0.03	0.14	0.42	0.11	0.01	0.00	0.00	0.00	0.00	0.00	0.71
1984	0.02	0.74	0.49	0.10	0.00	0.00	0.00	0.00	0.00	0.00	1.35
1985	0.35	0.31	0.28	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.97
1986	0.35	2.45	0.51	0.13	0.00	0.01	0.00	0.00	0.00	0.00	3.46
1987	0.04	0.94	0.37	0.02	0.04	0.00	0.00	0.00	0.00	0.00	1.42
1988	0.00	0.34	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58
1989	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
1990	0.05	0.67	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84
1991	0.00	0.12	0.08	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.22
1992	0.01	0.77	0.41	0.11	0.07	0.00	0.00	0.00	0.00	0.00	1.38
1993	0.01	0.41	0.22	0.07	0.00	0.00	0.03	0.00	0.00	0.00	0.74
1994	0.04	0.12	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19
1995	0.02	0.53	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.76
1996	0.10	0.95	1.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	2.09
1997	0.03	0.56	0.96	0.30	0.02	0.02	0.00	0.00	0.00	0.00	1.89
1998	0.00	0.09	0.36	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.54
1999	0.02	1.04	1.91	0.35	0.02	0.01	0.00	0.00	0.00	0.00	3.35
2000	0.40	0.50	1.24	0.45	0.14	0.03	0.00	0.00	0.00	0.00	2.76
2001	0.00	1.05	0.63	0.30	0.09	0.07	0.01	0.00	0.00	0.00	2.15
2002	0.44	2.42	1.38	0.40	0.08	0.02	0.03	0.03	0.00	0.00	4.79
2003	0.10	2.35	2.08	0.49	0.12	0.04	0.06	0.00	0.00	0.00	5.24
2004	0.03	0.48	1.30	0.78	0.19	0.06	0.01	0.00	0.00	0.00	2.85
2005	0.01	0.84	1.38	0.69	0.15	0.14	0.01	0.04	0.03	0.00	3.29
2006	0.10	0.14	1.13	0.44	0.16	0.02	0.01	0.00	0.00	0.00	2.00
2007	0.08	0.43	0.86	1.35	0.34	0.13	0.08	0.02	0.00	0.03	3.32
2008	0.12	0.55	1.10	0.62	0.85	0.41	0.16	0.10	0.02	0.00	3.93
2009	0.39	1.05	1.59	1.34	0.77	0.24	0.09	0.01	0.00	0.00	5.47
2010	0.02	0.91	1.24	0.79	0.63	0.45	0.13	0.05	0.03	0.04	4.29
2011	0.02	0.55	1.81	1.77	0.62	0.26	0.07	0.03	0.01	0.03	5.16

Table 51. Rhode Island Department of Fish and Wildlife (RIDFW) monthly fixed station trawl survey summer flounder index of abundance. RIDFW lengths aged with Northeast Fisheries Science Center (NEFSC) spring and fall trawl survey age-length keys.

Year	Age										
	0	1	2	3	4	5	6	7	8	9+	Total
1990	0.02	0.17	0.04	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.29
1991		0.07	0.08								0.15
1992	0.01	0.15	0.13	0.04	0.01						0.34
1993	0.01	0.11	0.09	0.04			0.01				0.26
1994	0.04	0.08	0.04		0.01						0.17
1995	0.03	0.02	0.02	0.01							0.08
1996	0.02	0.41	0.40	0.13							0.96
1997	0.04	0.17	0.38	0.13	0.01						0.73
1998		0.07	0.24	0.11	0.01						0.43
1999	0.03	0.26	0.37	0.17	0.05	0.02					0.90
2000	0.09	0.63	1.22	0.49	0.12	0.05	0.01				2.61
2001	0.01	0.42	0.28	0.15	0.06	0.04	0.02				0.98
2002	0.11	0.81	0.63	0.30	0.11	0.05		0.02			2.03
2003	0.05	1.48	1.44	0.45	0.24	0.08	0.04				3.78
2004	0.10	0.54	0.88	0.46	0.13	0.04	0.02				2.17
2005	0.04	0.55	0.98	0.53	0.17	0.16	0.02	0.03	0.01		2.49
2006	0.00	0.24	0.47	0.29	0.23	0.06	0.02	0.01			1.32
2007	0.04	0.25	0.51	0.55	0.20	0.07	0.05	0.01			1.68
2008	0.06	0.36	0.50	0.33	0.46	0.23	0.13	0.04	0.01		2.12
2009	0.12	0.89	1.50	1.28	0.74	0.36	0.12	0.04	0.02	0.01	5.08
2010	0.05	0.50	0.59	0.52	0.40	0.24	0.09	0.03	0.03	0.02	2.47
2011	0.07	0.53	1.16	1.03	0.42	0.24	0.07	0.04	0.02	0.02	3.59

Table 52. Connecticut Department of Environmental Protection (CTDEP) spring trawl survey: summer flounder index of abundance, geometric mean number per tow at age. CTDEP lengths aged with Northeast Fisheries Science Center (NEFSC) spring trawl survey age-length keys. No survey in 2010; n/a = not available.

Year	Age								
	0	1	2	3	4	5	6	7+	Total
1984	0.000	0.314	0.271	0.044	0.000	0.000	0.000	0.000	0.629
1985	0.000	0.015	0.325	0.040	0.058	0.003	0.000	0.000	0.441
1986	0.000	0.753	0.100	0.082	0.008	0.006	0.000	0.000	0.949
1987	0.000	0.951	0.086	0.014	0.004	0.001	0.000	0.001	1.057
1988	0.000	0.232	0.223	0.035	0.009	0.001	0.000	0.000	0.500
1989	0.000	0.013	0.049	0.024	0.016	0.000	0.000	0.000	0.102
1990	0.000	0.304	0.022	0.013	0.006	0.001	0.000	0.001	0.347
1991	0.000	0.392	0.189	0.029	0.028	0.001	0.000	0.000	0.639
1992	0.000	0.319	0.188	0.021	0.004	0.023	0.000	0.000	0.555
1993	0.000	0.320	0.151	0.015	0.018	0.003	0.000	0.001	0.508
1994	0.000	0.496	0.314	0.025	0.018	0.005	0.000	0.002	0.860
1995	0.000	0.199	0.051	0.020	0.005	0.000	0.000	0.006	0.281
1996	0.000	0.578	0.266	0.086	0.023	0.004	0.000	0.004	0.961
1997	0.000	0.391	0.507	0.057	0.036	0.004	0.002	0.002	0.999
1998	0.000	0.064	0.594	0.503	0.116	0.006	0.025	0.002	1.310
1999	0.000	0.245	0.593	0.385	0.139	0.053	0.025	0.000	1.440
2000	0.000	0.321	0.726	0.524	0.074	0.111	0.034	0.000	1.790
2001	0.000	0.841	0.340	0.365	0.120	0.043	0.032	0.007	1.748
2002	0.000	1.057	1.264	0.465	0.233	0.087	0.044	0.035	3.185
2003	0.000	1.608	1.016	0.395	0.232	0.085	0.046	0.039	3.421
2004	0.000	0.259	0.818	0.410	0.194	0.032	0.077	0.048	1.838
2005	0.000	0.253	0.264	0.150	0.033	0.036	0.039	0.029	0.804
2006	0.000	0.038	0.360	0.068	0.065	0.034	0.026	0.022	0.613
2007	0.000	1.152	0.210	0.560	0.316	0.115	0.089	0.065	2.507
2008	0.000	0.601	0.291	0.237	0.263	0.117	0.062	0.043	1.614
2009	0.000	0.777	0.377	0.291	0.180	0.195	0.070	0.040	1.930
2010	0.000	1.867	0.281	0.211	0.144	0.094	0.042	0.049	2.688
2011	0.000	1.002	1.084	0.801	0.382	0.316	0.110	0.153	3.848

Table 53. Connecticut Department of Environmental Protection (CTDEP) fall trawl survey: summer flounder index of abundance, geometric mean number per tow at age. CTDEP lengths aged with Northeast Fisheries Science Center (NEFSC) fall trawl survey age-length keys. No survey in 2010; n/a = not available.

Year	Age								
	0	1	2	3	4	5	6	7	Total
1984	0.000	0.571	0.331	0.072	0.014	0.004	0.004	0.003	0.999
1985	0.240	0.339	0.528	0.075	0.001	0.008	0.000	0.000	1.191
1986	0.172	1.170	0.298	0.072	0.006	0.001	0.000	0.000	1.719
1987	0.075	1.067	0.223	0.033	0.003	0.000	0.000	0.000	1.401
1988	0.015	0.884	0.481	0.037	0.002	0.001	0.000	0.000	1.420
1989	0.000	0.029	0.095	0.015	0.001	0.000	0.000	0.000	0.140
1990	0.032	0.674	0.110	0.042	0.007	0.005	0.000	0.000	0.870
1991	0.036	0.826	0.340	0.036	0.013	0.005	0.004	0.000	1.260
1992	0.013	0.570	0.366	0.046	0.016	0.009	0.000	0.000	1.020
1993	0.084	0.827	0.152	0.039	0.003	0.001	0.002	0.001	1.109
1994	0.132	0.300	0.085	0.024	0.009	0.000	0.000	0.000	0.550
1995	0.023	0.384	0.117	0.012	0.002	0.001	0.000	0.002	0.541
1996	0.069	0.887	1.188	0.042	0.005	0.000	0.000	0.000	2.191
1997	0.033	0.681	1.373	0.373	0.021	0.014	0.004	0.001	2.500
1998	0.000	0.269	1.054	0.321	0.054	0.021	0.000	0.000	1.719
1999	0.044	0.679	1.484	0.346	0.114	0.011	0.002	0.000	2.680
2000	0.112	0.395	0.871	0.341	0.124	0.043	0.011	0.013	1.910
2001	0.021	2.689	1.137	0.436	0.110	0.018	0.005	0.001	4.417
2002	0.442	3.087	1.930	0.479	0.123	0.031	0.024	0.005	6.121
2003	0.000	1.459	1.319	0.407	0.087	0.091	0.016	0.009	3.388
2004	0.255	0.385	0.755	0.440	0.080	0.024	0.015	0.000	1.954
2005	0.067	1.093	0.744	0.355	0.087	0.032	0.012	0.020	2.410
2006	0.098	0.217	0.592	0.230	0.096	0.044	0.021	0.018	1.315
2007	0.130	0.567	0.387	0.468	0.201	0.078	0.041	0.016	1.888
2008	0.681	0.515	1.155	0.660	0.048	0.013	0.013	0.000	3.085
2009	0.405	0.661	0.888	0.624	0.318	0.133	0.044	0.044	3.117
2010									n/a
2011	0.117	0.693	0.933	0.564	0.123	0.054	0.028	0.084	2.558

Table 54. New Jersey Bureau of Marine Fisheries (NJBMF) trawl survey, April - October: index of summer flounder abundance. NJBMF lengths aged with Northeast Fisheries Science Center fall trawl survey age-length keys.

Year	0	1	2	3	4	5	6	7	8	9	Total
1988	0.17	3.06	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.26
1989	1.00	0.51	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.69
1990	1.28	1.44	0.11	0.03	0.00	0.00	0.00	0.00	0.00	0.00	2.86
1991	1.00	2.69	0.27	0.02	0.00	0.00	0.00	0.00	0.00	0.00	3.98
1992	1.10	3.00	0.57	0.06	0.02	0.00	0.00	0.00	0.00	0.00	4.75
1993	2.55	5.69	0.20	0.01	0.01	0.00	0.00	0.00	0.00	0.00	8.46
1994	1.66	1.07	0.08	0.00	0.02	0.00	0.00	0.00	0.00	0.00	2.83
1995	5.12	2.94	0.26	0.07	0.02	0.00	0.00	0.00	0.00	0.00	8.41
1996	1.66	5.10	2.70	0.18	0.05	0.00	0.00	0.00	0.00	0.00	9.69
1997	1.65	8.25	5.25	1.02	0.10	0.07	0.01	0.00	0.00	0.00	16.35
1998	0.67	5.80	2.67	0.29	0.03	0.01	0.00	0.00	0.00	0.00	9.47
1999	1.03	6.12	3.46	0.65	0.12	0.06	0.00	0.00	0.00	0.00	11.44
2000	0.99	3.94	1.85	0.46	0.12	0.06	0.04	0.00	0.00	0.00	7.46
2001	0.62	3.32	1.18	0.41	0.09	0.03	0.02	0.00	0.00	0.00	5.68
2002	1.51	9.11	4.13	1.28	0.47	0.24	0.05	0.04	0.00	0.00	16.84
2003	0.60	5.61	2.55	0.57	0.19	0.19	0.07	0.06	0.00	0.00	9.84
2004	0.90	6.27	2.49	0.57	0.19	0.11	0.10	0.03	0.00	0.00	10.66
2005	3.11	5.99	1.24	0.53	0.17	0.10	0.03	0.01	0.01	0.00	11.19
2006	0.81	5.74	3.22	0.48	0.20	0.11	0.08	0.02	0.00	0.00	10.65
2007	0.64	4.10	2.49	1.22	0.31	0.12	0.09	0.01	0.00	0.00	8.98
2008	1.31	2.34	1.61	0.45	0.37	0.12	0.07	0.01	0.01	0.00	6.29
2009	1.68	2.82	2.15	1.02	0.40	0.12	0.08	0.02	0.01	0.00	8.31
2010	1.28	4.53	2.75	1.48	0.67	0.23	0.09	0.01	0.01	0.02	11.07
2011	1.05	2.38	1.86	0.97	0.27	0.20	0.07	0.05	0.01	0.01	6.92

Table 55. Delaware Division of Fish and Wildlife 16 foot trawl survey: index of summer flounder recruitment at age-0 in the Delaware Bay Estuary.

Year	Geometric Mean number per tow
1980	0.12
1981	0.06
1982	0.11
1983	0.03
1984	0.08
1985	0.06
1986	0.10
1987	0.14
1988	0.01
1989	0.12
1990	0.23
1991	0.07
1992	0.31
1993	0.03
1994	0.29
1995	0.17
1996	0.03
1997	0.02
1998	0.03
1999	0.05
2000	0.18
2001	0.07
2002	0.07
2003	0.09
2004	0.10
2005	0.00
2006	0.02
2007	0.03
2008	0.05
2009	0.31
2010	0.04
2011	0.02

Table 56. Delaware Division of Fish and Wildlife 16 foot trawl survey: index of summer flounder recruitment at age-0 in Delaware Inland Bays.

Year	Geometric Mean number per tow
1986	0.317
1987	0.258
1988	0.013
1989	0.139
1990	0.361
1991	0.378
1992	0.368
1993	0.047
1994	0.571
1995	0.301
1996	0.080
1997	0.222
1998	0.390
1999	0.350
2000	0.205
2001	0.142
2002	0.125
2003	0.214
2004	0.268
2005	0.012
2006	0.170
2007	0.170
2008	0.200
2009	0.420
2010	0.130
2011	0.223

Table 57. Delaware Division of Fish and Wildlife Delaware Bay 30 foot trawl survey: index of summer flounder abundance.

Year	0	1	2	3	4	5	6	7	8	Total
1991	1.44	1.13	0.18	0.04	0.00	0.00	0.00	0.00	0.00	2.79
1992	0.47	0.28	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.83
1993	0.04	1.56	0.73	0.07	0.00	0.00	0.00	0.00	0.00	2.40
1994	2.03	0.14	0.22	0.08	0.00	0.00	0.00	0.00	0.00	2.72
1995	0.95	1.00	0.28	0.10	0.07	0.02	0.00	0.00	0.00	2.41
1996	0.46	0.73	0.48	0.10	0.01	0.00	0.01	0.00	0.00	1.79
1997	0.03	0.12	0.49	0.47	0.11	0.00	0.03	0.01	0.01	1.27
1998	0.11	0.31	0.83	0.29	0.11	0.01	0.00	0.00	0.00	1.66
1999	0.20	0.06	0.77	0.47	0.16	0.03	0.00	0.00	0.00	1.69
2000	0.79	0.24	0.30	0.28	0.15	0.04	0.00	0.00	0.00	1.84
2001	0.34	1.55	0.49	0.26	0.10	0.02	0.01	0.00	0.00	2.77
2002	0.04	0.23	0.09	0.00	0.03	0.00	0.00	0.00	0.00	0.39
2003	0.15	0.14	0.29	0.15	0.07	0.03	0.02	0.00	0.00	0.85
2004	0.02	0.07	0.06	0.01	0.01	0.01	0.00	0.00	0.00	0.18
2005	0.00	0.30	0.11	0.02	0.01	0.00	0.00	0.00	0.00	0.44
2006	0.41	0.10	0.23	0.07	0.01	0.01	0.00	0.00	0.00	0.83
2007	0.11	0.14	0.83	0.09	0.07	0.02	0.00	0.00	0.01	1.29
2008	0.20	0.35	0.12	0.02	0.01	0.02	0.01	0.00	0.00	0.73
2009	0.45	0.49	0.10	0.09	0.01	0.01	0.00	0.00	0.00	1.16
2010	0.04	0.46	0.35	0.13	0.03	0.01	0.00	0.00	0.00	1.03
2011	0.36	0.24	0.19	0.07	0.05	0.00	0.01	0.00	0.00	0.92

Table 58. Maryland Department of Natural Resources Coastal Bays trawl survey: index of summer flounder recruitment at age-0. Geometric mean (re-transformed ln [number per hectare + 1]).

Year	Geo. mean n/tow	Lower 95% CI	Upper 95% CI
1972	34.351	13.426	87.888
1973	10.321	5.529	19.267
1974	12.311	7.516	20.165
1975	3.606	2.547	5.104
1976	4.207	2.833	6.246
1977	4.337	2.728	6.894
1978	5.731	3.959	8.295
1979	6.715	4.077	11.060
1980	7.395	3.953	13.837
1981	8.849	5.544	14.123
1982	3.408	1.663	6.983
1983	17.699	0.031	10223.618
1984	13.310	7.161	24.738
1985	12.843	7.472	22.076
1986	59.526	21.950	161.427
1987	7.584	3.590	16.018
1988	1.763	1.371	2.267
1989	2.855	2.121	3.843
1990	4.733	3.639	6.156
1991	7.337	5.508	9.772
1992	8.487	6.285	11.461
1993	4.145	3.192	5.383
1994	22.311	16.486	30.194
1995	13.067	9.811	17.404
1996	6.493	4.954	8.509
1997	7.997	5.948	10.752
1998	14.983	11.391	19.708
1999	8.565	6.477	11.326
2000	9.874	7.272	13.407

Table 58, continued. Maryland Department of Natural Resources Coastal Bays trawl survey: index of summer flounder recruitment at age-0. Geometric mean (re-transformed ln [number per hectare + 1]).

Year	Geo. mean n/tow	Lower 95% CI	Upper 95% CI
2001	13.543	9.945	18.442
2002	5.406	4.136	7.066
2003	8.180	6.064	11.035
2004	6.993	5.230	9.350
2005	2.198	1.783	2.709
2006	9.658	7.263	12.843
2007	15.438	11.588	20.573
2008	12.079	9.214	15.834
2009	17.887	13.129	24.368
2010	6.713	5.170	8.717
2011	4.471	3.444	5.804

Table 59. Virginia Institute of Marine Science (VIMS) juvenile fish trawl survey: index of summer flounder recruitment at age-0. Includes all available data and incorporates gear conversion factors from studies conducted in the late 1990s. There was no survey in 1960.

Year	Geometric mean catch per trawl	Lower 95% confidence limit	Upper 95% confidence limit	Number of stations
1955	0.00	0.00	0.00	2
1956	4.44	2.91	6.56	29
1957	2.14	1.22	3.42	28
1958	1.48	0.23	4.00	27
1959	0.06	-0.03	0.15	27
1960				
1961	0.19	0.12	0.61	11
1962	0.00	0.00	0.00	7
1963	2.07	0.78	4.29	12
1964	0.65	0.54	0.76	16
1965	0.74	0.27	1.39	13
1966	0.00	0.00	0.00	17
1967	0.43	-0.17	1.46	27
1968	0.14	-0.05	0.36	27
1969	0.20	0.04	0.38	27
1970	0.04	-0.02	0.10	29
1971	3.72	3.43	4.04	129
1972	0.85	0.79	0.92	84
1973	1.27	0.77	1.89	94
1974	0.82	0.31	1.51	32
1975	0.14	0.00	0.30	22
1976	0.57	0.32	0.86	68
1977	1.67	1.16	2.31	36
1978	1.24	0.47	2.40	36
1979	2.94	2.74	3.15	50
1980	10.69	6.49	17.25	70
1981	3.97	2.39	6.31	67
1982	2.27	1.54	3.21	64
1983	5.01	3.62	6.82	60
1984	1.58	0.96	2.39	41
1985	1.26	0.52	2.37	27
1986	1.26	0.77	1.89	53
1987	0.39	0.20	0.63	52
1988	0.54	0.35	0.75	143
1989	1.24	0.94	1.58	162

Table 59, continued. Virginia Institute of Marine Science (VIMS) juvenile fish trawl survey: index of summer flounder recruitment at age-0. Includes all available data and incorporates gear conversion factors from studies conducted in the late 1990s. There was no survey in 1960.

Year	Geometric mean catch per trawl	Lower 95% confidence limit	Upper 95% confidence limit	Number of stations
1990	2.54	2.06	3.09	162
1991	2.79	2.26	3.41	153
1992	0.92	0.70	1.17	153
1993	0.52	0.38	0.68	153
1994	2.54	2.01	3.15	153
1995	0.71	0.52	0.92	149
1996	0.81	0.62	1.02	224
1997	0.89	0.69	1.12	226
1998	0.73	0.55	0.93	226
1999	0.53	0.41	0.67	219
2000	0.57	0.43	0.73	227
2001	0.47	0.34	0.61	236
2002	0.77	0.54	1.04	179
2003	0.44	0.33	0.56	225
2004	1.30	1.03	1.60	225
2005	0.35	0.25	0.46	225
2006	0.80	0.60	1.02	203
2007	1.00	0.78	1.24	225
2008	1.35	1.10	1.63	225
2009	0.75	0.58	0.92	225
2010	0.55	0.41	0.69	225
2011	0.17	0.11	0.23	225

Table 60. Virginia Institute of Marine Science (VIMS) Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) trawl survey indices for summer flounder. Aggregate indices (A) are delta-lognormal model geometric means per tow. Aged indices (B) are in numbers, are compiled independently, and are aged using a smoothed age-length key, and so do not total to the aggregate numeric indices.

A.

Year	Number (CV %)	Biomass (CV %)
2002	120.30 (5)	53.57 (6)
2003	35.35 (8)	11.76 (10)
2004	46.05 (6)	17.48 (6)
2005	150.05 (4)	56.06 (5)
2006	179.10 (5)	61.71 (5)
2007	116.00 (7)	39.05 (7)
2008	86.39 (6)	30.39 (7)
2009	35.11 (8)	15.70 (8)
2010	36.61 (7)	15.57 (8)
2011	23.19 (8)	14.12 (9)

B.

Year	0	1	2	3	4	5	6	7+	Total
2002	46.15	28.75	11.81	6.59	2.11	2.97	1.00	0.64	100.02
2003	12.18	16.35	6.95	3.40	0.98	1.26	0.48	0.26	41.86
2004	21.50	8.65	4.87	2.97	0.83	1.12	0.40	0.21	40.55
2005	42.63	32.14	16.00	7.01	1.54	2.17	0.86	0.27	102.62
2006	79.82	30.00	12.27	6.70	1.74	2.33	0.79	0.40	134.05
2007	74.77	22.52	7.17	3.88	0.93	1.41	0.49	0.29	111.46
2008	41.29	9.66	7.02	4.82	1.44	1.93	0.83	0.39	67.38
2009	12.79	8.45	4.32	2.62	0.80	1.07	0.41	0.19	30.65
2010	13.31	9.79	4.20	2.04	0.57	0.81	0.29	0.14	31.15
2011	2.81	8.33	6.26	3.10	0.76	1.03	0.33	0.10	22.72

Table 61. Virginia Institute of Marine Science (VIMS) Northeast Area Monitoring and Assessment Program (NEAMAP) trawl survey indices for summer flounder. Indices are calculated as delta-lognormal model stratified geometric mean numbers and biomass (kg) per standard area swept tow.

Season	Number per tow	Number CV (%)	Biomass per tow	Biomass CV (%)
Fall 2007	4.31	3.4	2.65	4.4
Fall 2008	2.76	5.1	1.71	5.4
Fall 2009	4.99	4.1	2.42	4.4
Fall 2010	3.99	4.0	2.02	5.0
Fall 2011	2.55	4.7	1.48	6.0
Spring 2008	3.09	4.4	1.93	5.0
Spring 2009	2.56	5.1	1.52	5.9
Spring 2010	2.36	5.8	1.34	6.0
Spring 2011	3.22	4.6	1.68	5.3

Table 62. Virginia Institute of Marine Science (VIMS) Northeast Area Monitoring and Assessment Program (NEAMAP) trawl survey indices at age for summer flounder. Aged indices are in numbers, are compiled independently, and are aged using a smoothed age-length key, and so do not total to the aggregate numeric indices in Table 60.

Spring

Year	1	2	3	4	5	6	7+	Total
2008	0.67	1.19	0.67	0.26	0.42	0.17	0.15	3.53
2009	0.86	0.84	0.48	0.20	0.32	0.13	0.10	2.93
2010	0.78	0.94	0.41	0.14	0.25	0.11	0.09	2.72
2011	1.12	1.51	0.60	0.15	0.31	0.12	0.08	3.89

Fall

Year	0	1	2	3	4	5	6	7+	Total
2007	0.84	1.44	0.93	0.61	0.16	0.24	0.06	0.07	4.35
2008	0.52	0.97	0.84	0.40	0.08	0.11	0.04	0.03	2.99
2009	1.43	1.33	0.92	0.52	0.12	0.18	0.05	0.06	4.61
2010	1.11	1.30	0.81	0.39	0.09	0.13	0.04	0.04	3.91
2011	0.43	0.96	0.68	0.33	0.08	0.11	0.04	0.05	2.68

Table 63. North Carolina Division of Marine Fisheries (NCDMF) Pamlico Sound trawl survey: June index of summer flounder recruitment at age-0.

Year	Mean number per tow	CV (%)
1987	19.86	14
1988	2.61	34
1989	6.63	17
1990	4.27	18
1991	5.85	24
1992	9.14	19
1993	5.13	24
1994	8.17	24
1995	6.65	25
1996	30.67	18
1997	14.14	21
1998	10.44	41
1999	n/a	n/a
2000	3.94	21
2001	22.03	15
2002	18.28	18
2003	7.23	24
2004	5.90	20
2005	9.88	22
2006	1.96	22
2007	3.62	22
2008	14.40	22
2009	4.53	22
2010	14.28	22
2011	6.64	22

Table 64. Summary results for Spawning Stock Biomass (SSB) in metric tons (mt); Recruitment (R) at age 0 (000s); Fishing Mortality (F) for fully recruited ages 3-7+.

Year	SSB	R	F
1982	25,006	71,569	1.104
1983	24,813	80,678	1.418
1984	21,029	44,692	1.552
1985	18,670	56,822	1.486
1986	17,884	61,410	1.674
1987	18,402	46,312	1.403
1988	10,897	12,806	1.981
1989	7,040	28,567	1.502
1990	9,589	37,051	1.113
1991	9,135	30,908	1.450
1992	10,653	36,155	1.479
1993	12,471	37,421	1.220
1994	15,431	41,846	1.125
1995	20,835	49,228	1.858
1996	23,673	35,679	1.552
1997	24,660	34,969	0.968
1998	27,130	38,257	0.862
1999	28,560	31,124	0.628
2000	34,235	39,465	0.609
2001	36,661	37,294	0.513
2002	41,548	44,350	0.451
2003	45,749	34,375	0.431
2004	46,855	55,550	0.472
2005	45,674	30,815	0.482
2006	47,943	38,461	0.352
2007	49,828	42,296	0.248
2008	52,235	46,698	0.226
2009	55,954	46,573	0.199
2010	57,427	31,891	0.203
2011	57,020	25,990	0.241

Table 65. January 1 population number (000s) estimates at age.

	Age								
	0	1	2	3	4	5	6	7+	Total
1982	71,976	46,061	21,280	3,253	724	287	78	24	143,684
1983	81,058	54,025	21,754	5,669	841	187	74	27	163,634
1984	44,902	60,396	22,233	4,278	1,069	158	35	19	133,091
1985	57,136	33,346	23,423	3,849	707	176	26	9	118,672
1986	61,716	42,586	13,522	4,330	680	125	31	6	122,995
1987	46,504	45,607	15,414	2,078	633	99	18	5	110,358
1988	12,849	34,602	18,655	3,077	398	121	19	5	69,725
1989	28,697	9,440	11,063	2,134	331	43	13	3	51,723
1990	37,247	20,815	3,112	1,984	371	57	7	3	63,596
1991	31,074	27,250	8,099	810	508	95	15	3	67,854
1992	36,405	22,593	9,265	1,525	148	93	17	3	70,050
1993	37,672	26,693	8,120	1,707	271	26	16	4	74,509
1994	42,155	27,591	10,182	1,910	393	62	6	5	82,303
1995	49,611	31,127	11,464	2,633	483	99	16	3	95,435
1996	35,943	37,735	20,330	3,365	347	57	12	2	97,792
1997	35,220	27,398	25,300	6,982	593	56	9	2	95,561
1998	38,519	26,954	19,291	11,722	2,146	173	16	3	98,825
1999	31,315	29,480	19,013	9,361	3,970	694	56	6	93,896
2000	39,649	23,907	20,299	9,882	3,865	1,616	287	26	99,532
2001	37,388	30,366	17,037	11,070	4,230	1,612	679	133	102,516
2002	44,405	28,642	21,726	9,712	5,179	1,942	747	380	112,733
2003	34,531	34,072	20,856	12,979	4,859	2,540	958	561	111,356
2004	56,074	26,498	24,839	12,574	6,609	2,429	1,277	771	131,071
2005	31,090	43,033	19,328	14,778	6,214	3,196	1,180	1,004	119,822
2006	38,784	23,859	31,384	11,477	7,274	2,992	1,546	1,068	118,382
2007	42,587	29,793	17,607	19,838	6,323	3,945	1,629	1,436	123,157
2008	46,928	32,706	21,953	11,577	11,949	3,786	2,378	1,869	133,146
2009	46,815	36,034	24,069	14,600	7,167	7,379	2,357	2,675	141,097
2010	32,085	35,973	26,724	16,297	9,256	4,528	4,690	3,236	132,789
2011	26,146	24,655	26,690	18,116	10,349	5,856	2,882	5,096	119,790

Table 66. Fishing mortality (F) estimates at age.

	Age							
	0	1	2	3	4	5	6	7+
1982	0.027	0.490	1.063	1.103	1.104	1.105	1.105	1.105
1983	0.034	0.628	1.366	1.418	1.420	1.420	1.420	1.420
1984	0.038	0.687	1.494	1.551	1.552	1.552	1.552	1.552
1985	0.034	0.643	1.428	1.484	1.486	1.486	1.486	1.486
1986	0.042	0.756	1.613	1.674	1.675	1.675	1.675	1.675
1987	0.036	0.634	1.351	1.402	1.404	1.404	1.404	1.404
1988	0.048	0.880	1.908	1.981	1.983	1.983	1.983	1.983
1989	0.061	0.850	1.458	1.499	1.501	1.501	1.501	1.501
1990	0.052	0.684	1.086	1.113	1.114	1.114	1.114	1.114
1991	0.059	0.819	1.410	1.450	1.451	1.451	1.451	1.451
1992	0.050	0.763	1.431	1.477	1.479	1.479	1.479	1.479
1993	0.051	0.704	1.187	1.220	1.221	1.221	1.221	1.221
1994	0.043	0.618	1.093	1.125	1.126	1.126	1.126	1.126
1995	0.014	0.166	0.966	1.776	1.884	1.882	1.874	1.868
1996	0.011	0.140	0.809	1.485	1.575	1.573	1.566	1.561
1997	0.007	0.091	0.509	0.930	0.985	0.982	0.977	0.974
1998	0.007	0.089	0.463	0.833	0.878	0.874	0.868	0.864
1999	0.010	0.113	0.394	0.635	0.649	0.632	0.619	0.610
2000	0.007	0.079	0.346	0.598	0.624	0.617	0.610	0.605
2001	0.006	0.075	0.302	0.510	0.528	0.520	0.512	0.507
2002	0.005	0.057	0.255	0.443	0.462	0.457	0.452	0.449
2003	0.005	0.056	0.246	0.425	0.443	0.438	0.433	0.429
2004	0.005	0.056	0.259	0.455	0.477	0.472	0.467	0.465
2005	0.005	0.056	0.261	0.459	0.481	0.476	0.472	0.469
2006	0.004	0.044	0.199	0.346	0.362	0.358	0.354	0.352
2007	0.004	0.045	0.159	0.257	0.263	0.256	0.251	0.247
2008	0.004	0.047	0.148	0.229	0.232	0.224	0.218	0.214
2009	0.003	0.039	0.130	0.206	0.209	0.203	0.198	0.195
2010	0.003	0.038	0.129	0.204	0.208	0.202	0.197	0.194
2011	0.004	0.041	0.147	0.238	0.244	0.238	0.234	0.231

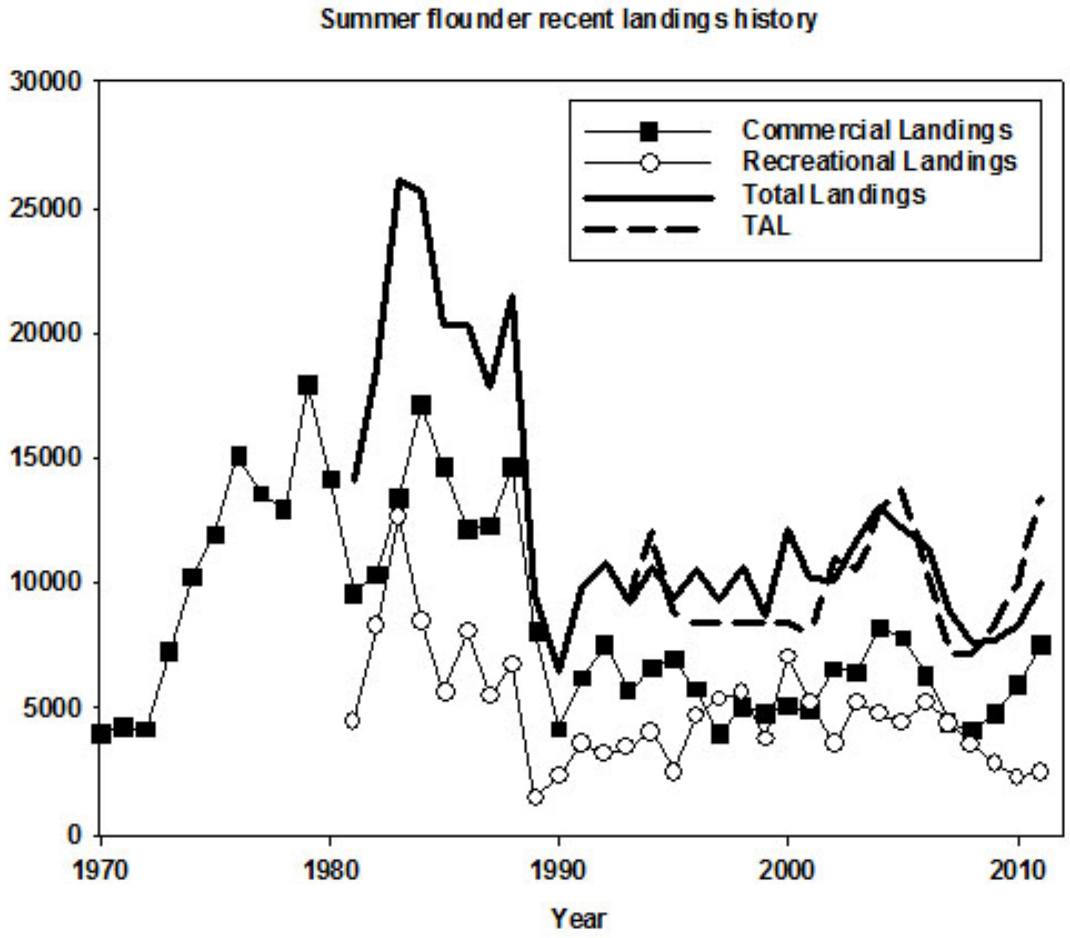

Figure 1. Summer flounder recent commercial (1970-2011), recreational (1981-2011; Marine Recreational Fishery Statistics Survey), total fishery (1981-2011) landings, and the corresponding fishery Total Allowable Landings (TAL).

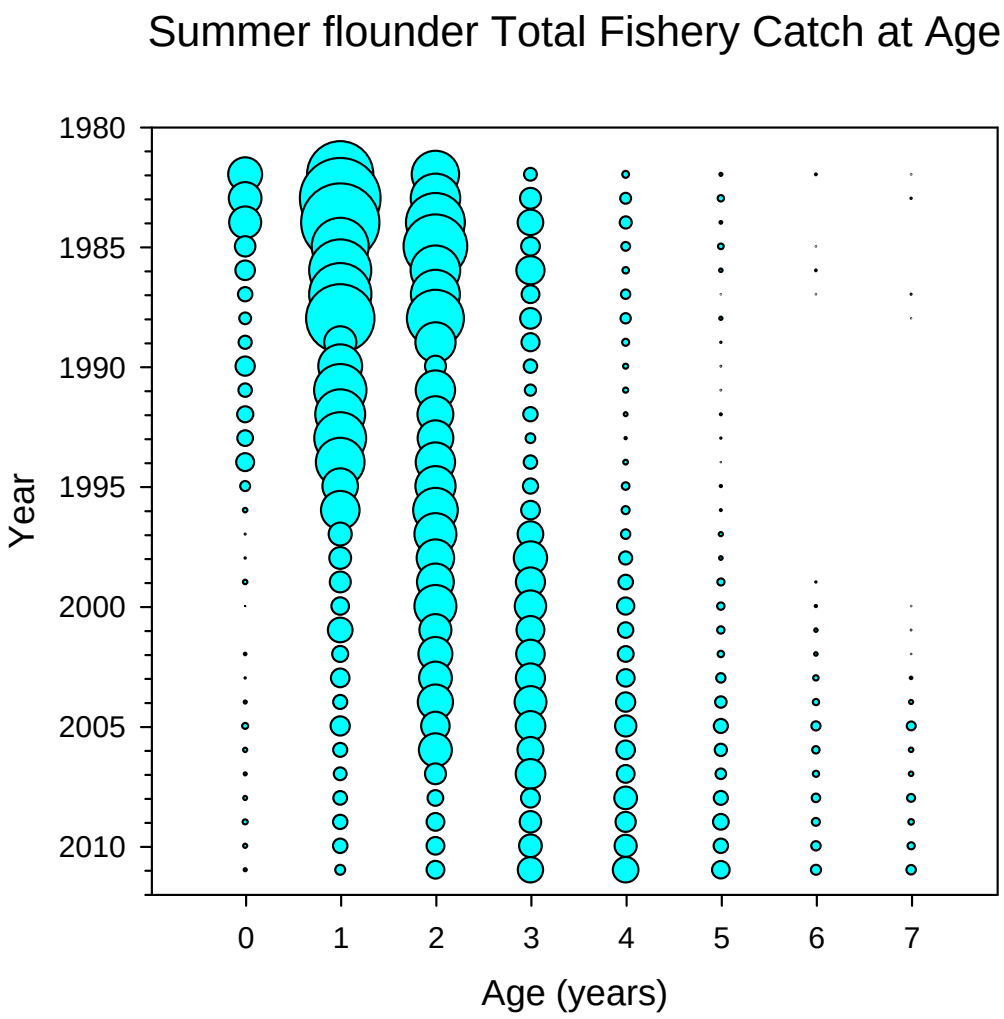

Figure 2. Total fishery catch at age for summer flounder.

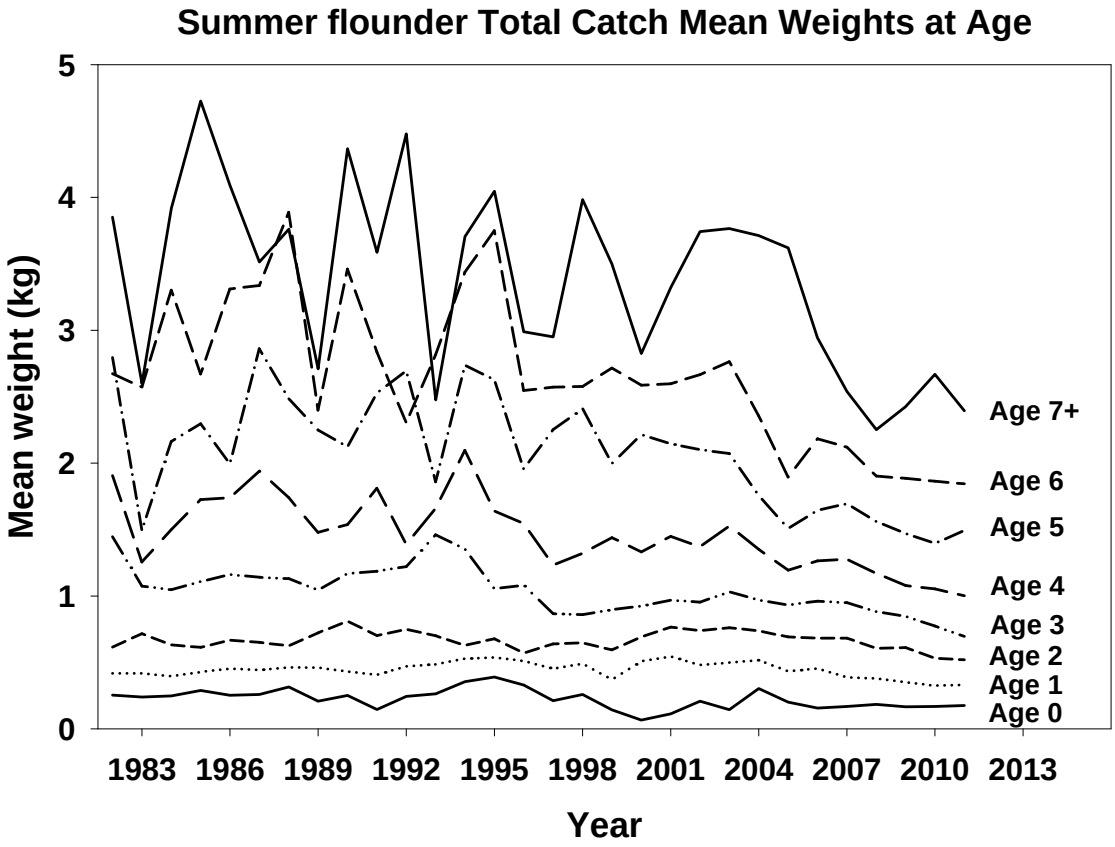

Figure 3. Mean weight at age in the total fishery catch of summer flounder.

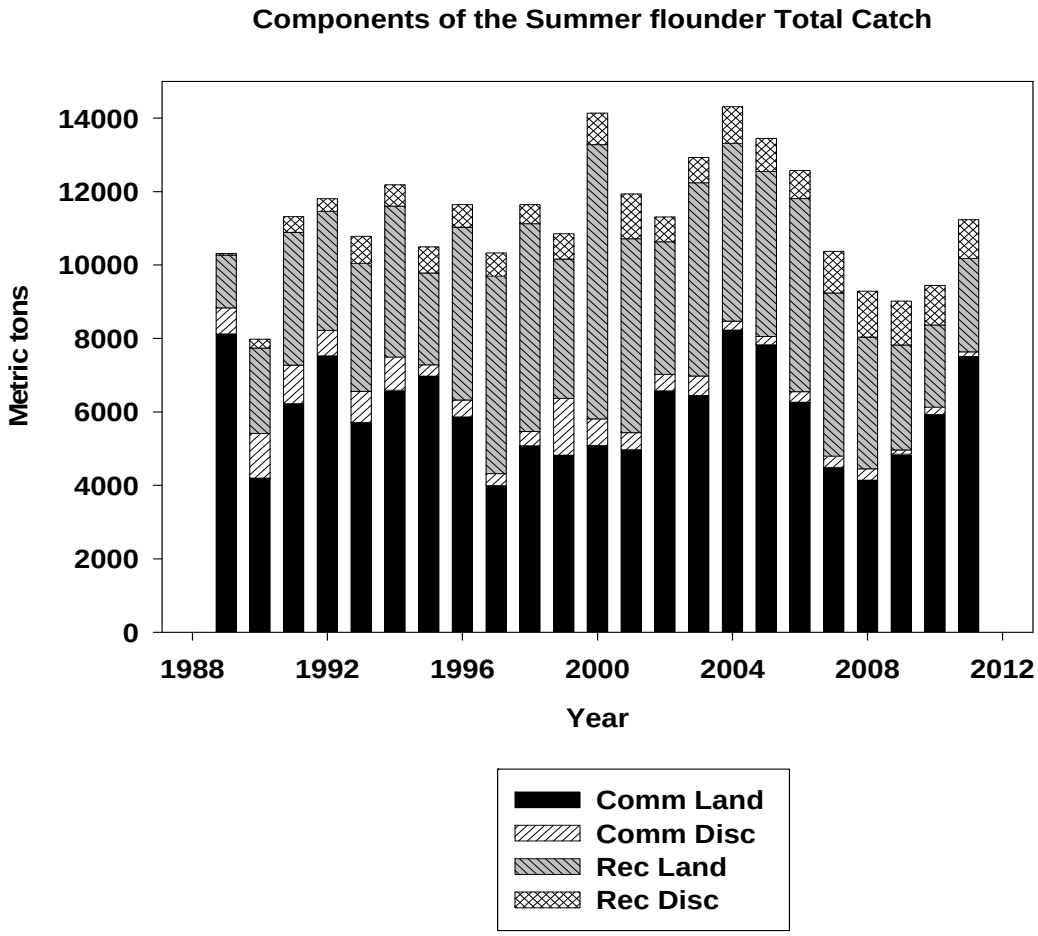

Figure 4. Components of the summer flounder fishery catch in terms of commercial landings and discards and recreational landings and discards.

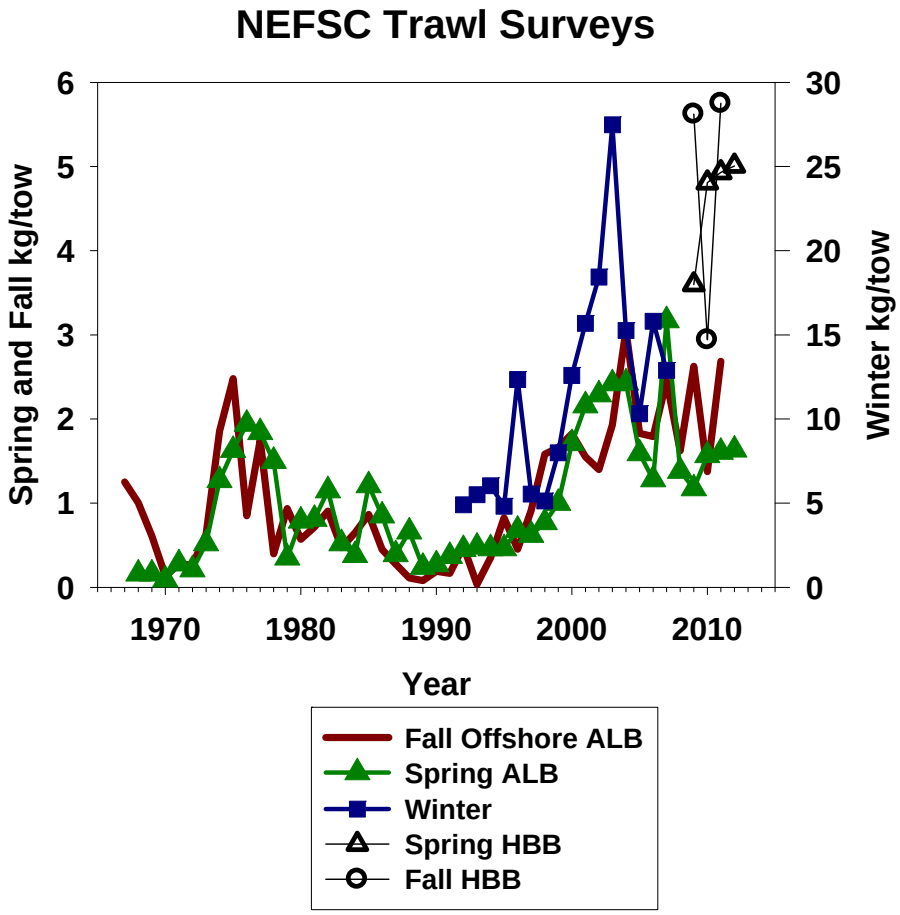

Figure 5. Trends in Northeast Fisheries Science Center trawl survey biomass indices for summer flounder. Surveys conducted aboard the *Albatross IV (ALB)* and the *Henry B. Bigelow* (HBB).

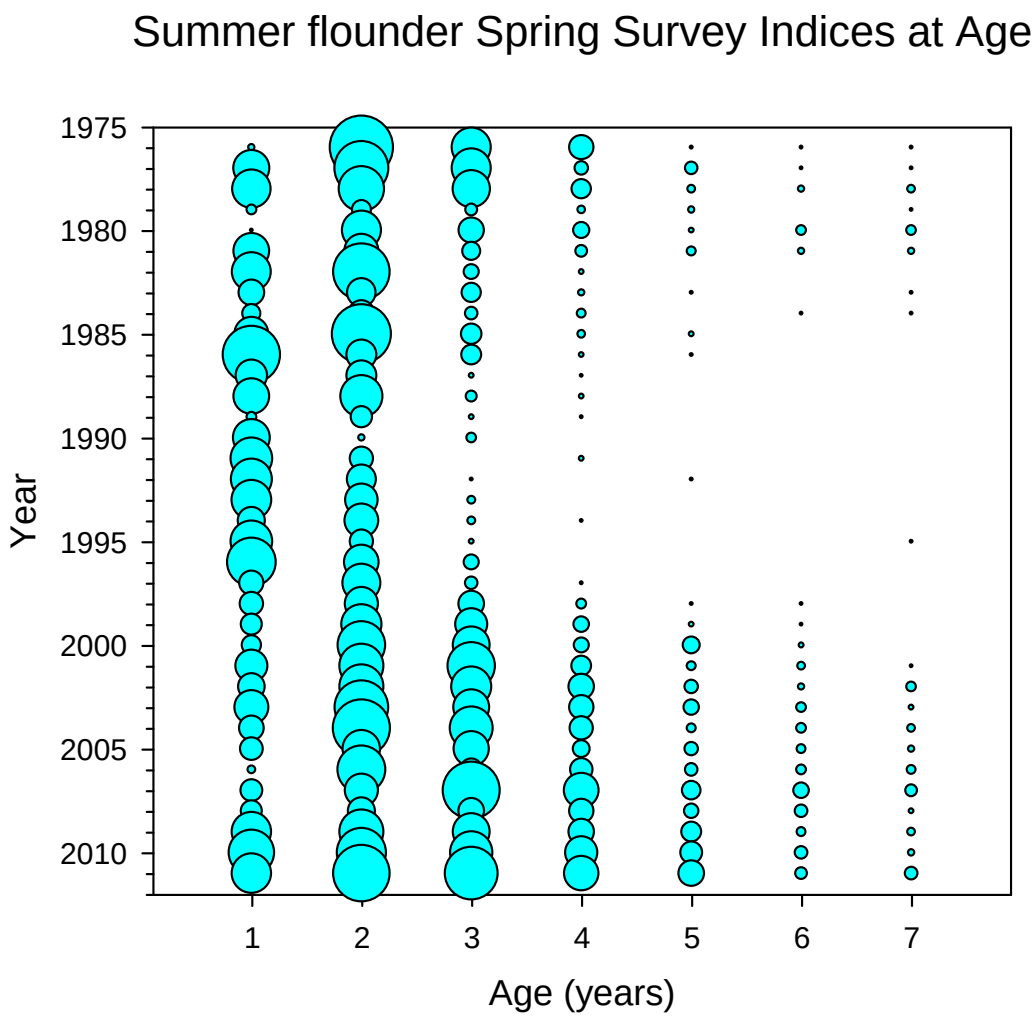

Figure 6. Northeast Fisheries Science Center spring trawl survey catch at age.

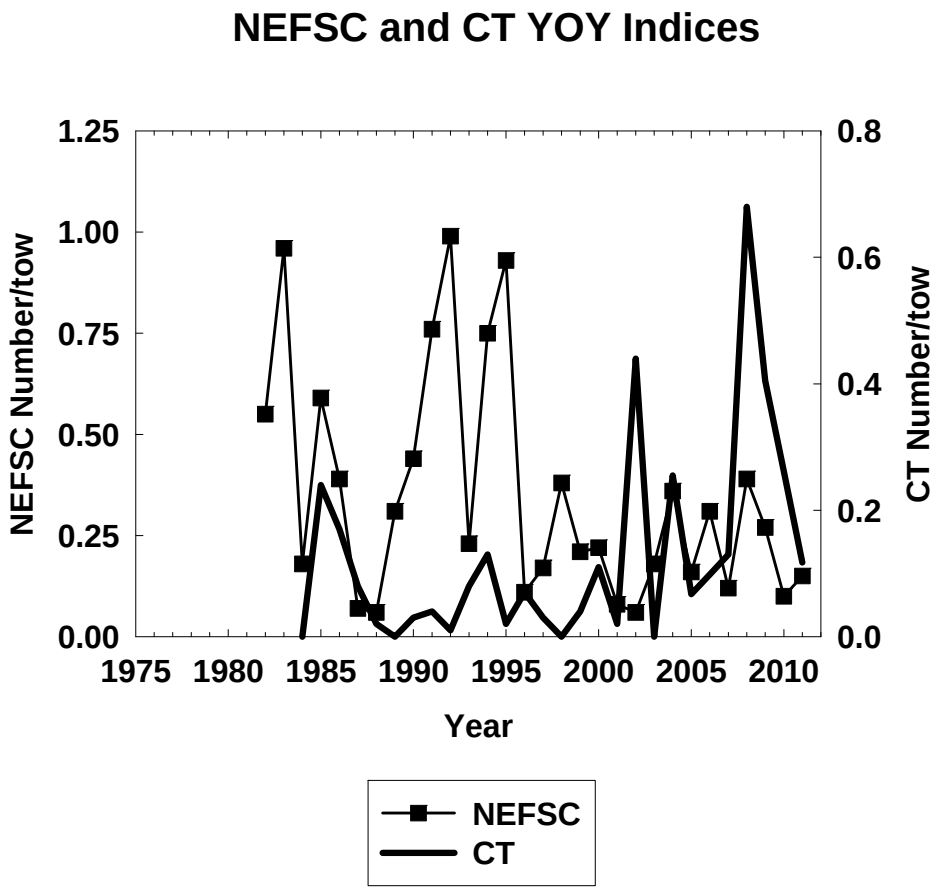

Figure 7. Trends in Northeast Fisheries Science Center and Connecticut (CT) trawl survey recruitment indices for summer flounder young of the year (YOY).

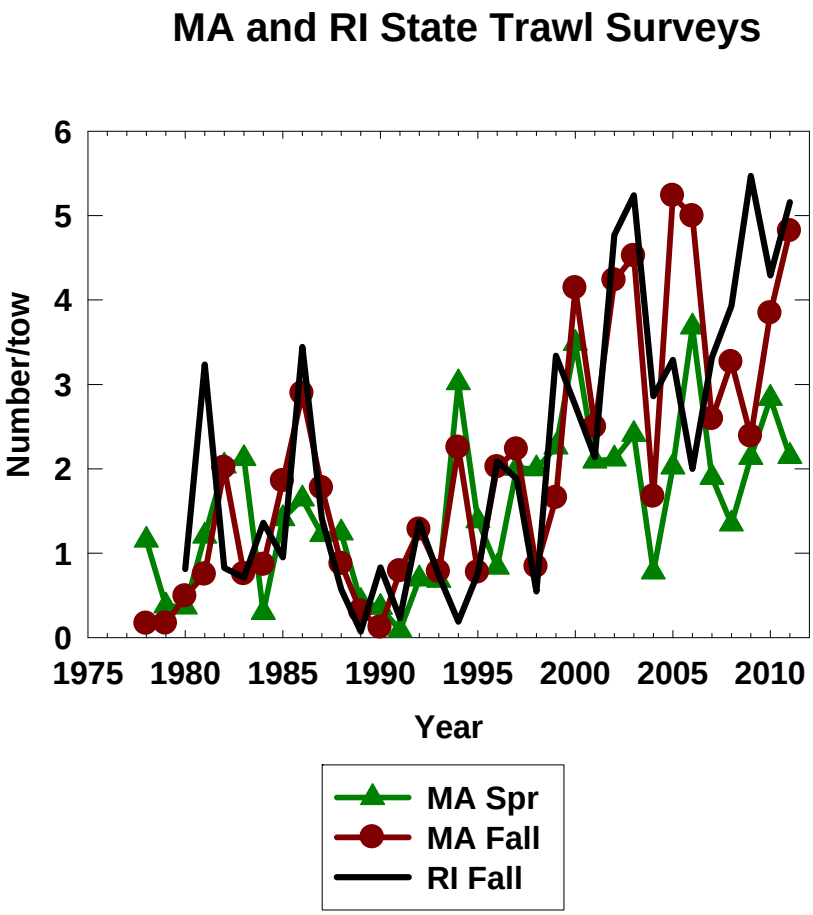

Figure 8. Trends in Massachusetts (MA) and Rhode Island (RI) trawl survey abundance indices for summer flounder.

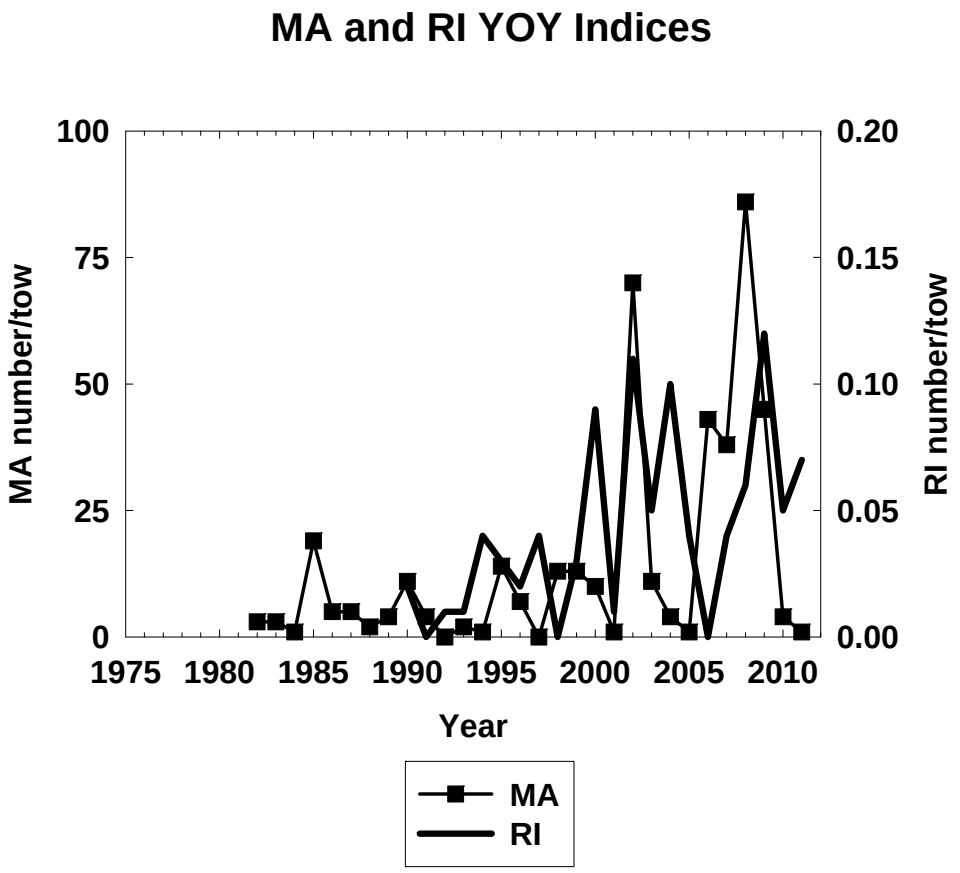

Figure 9. Trends in Massachusetts (MA) and Rhode Island (RI) trawl survey recruitment indices for summer flounder young of the year (YOY).

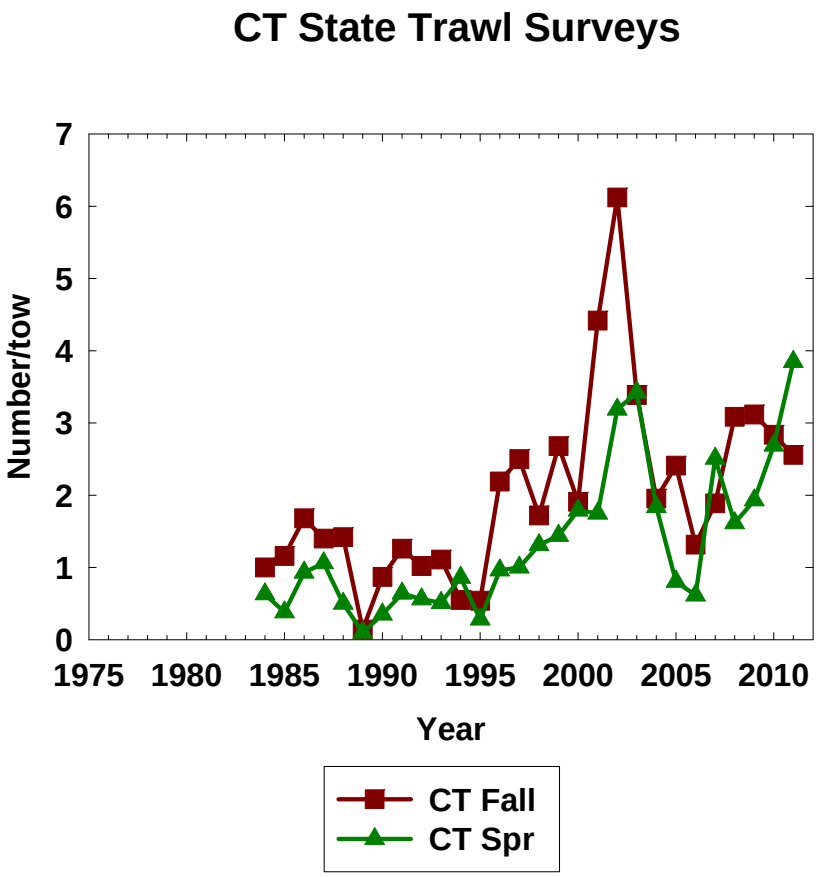

Figure 10. Trends in Connecticut (CT) trawl survey abundance indices for summer flounder.

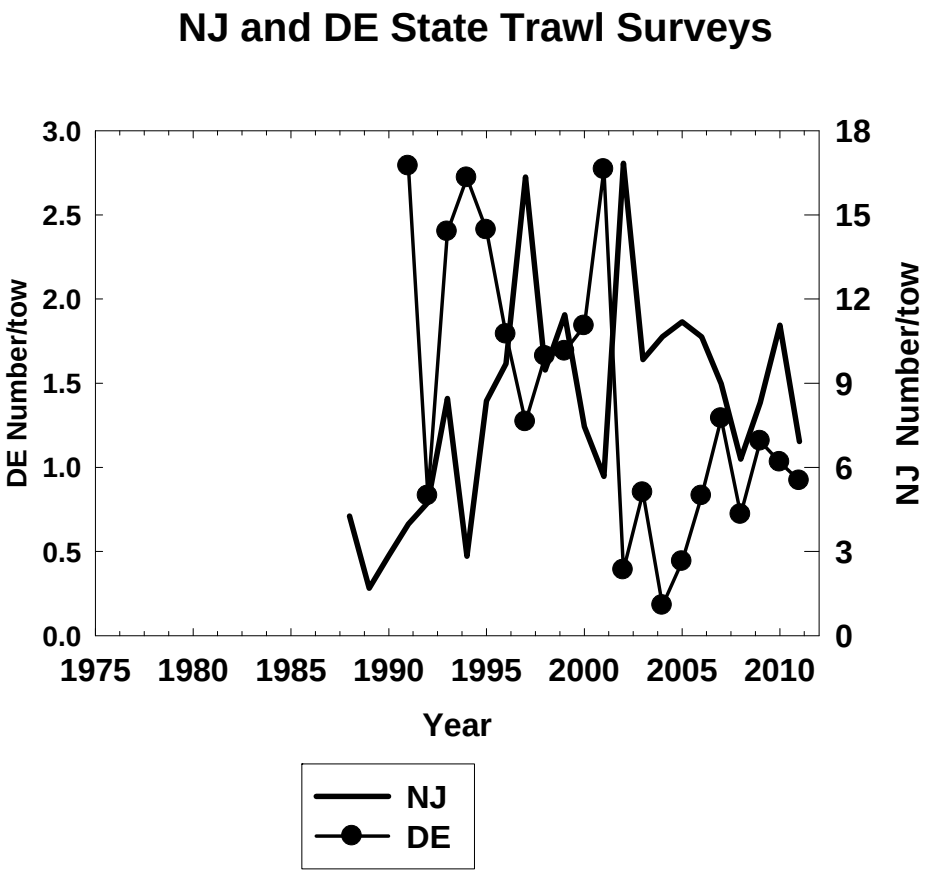

Figure 11. Trends in New Jersey (NJ) and Delaware (DE) trawl survey abundance indices for summer flounder.

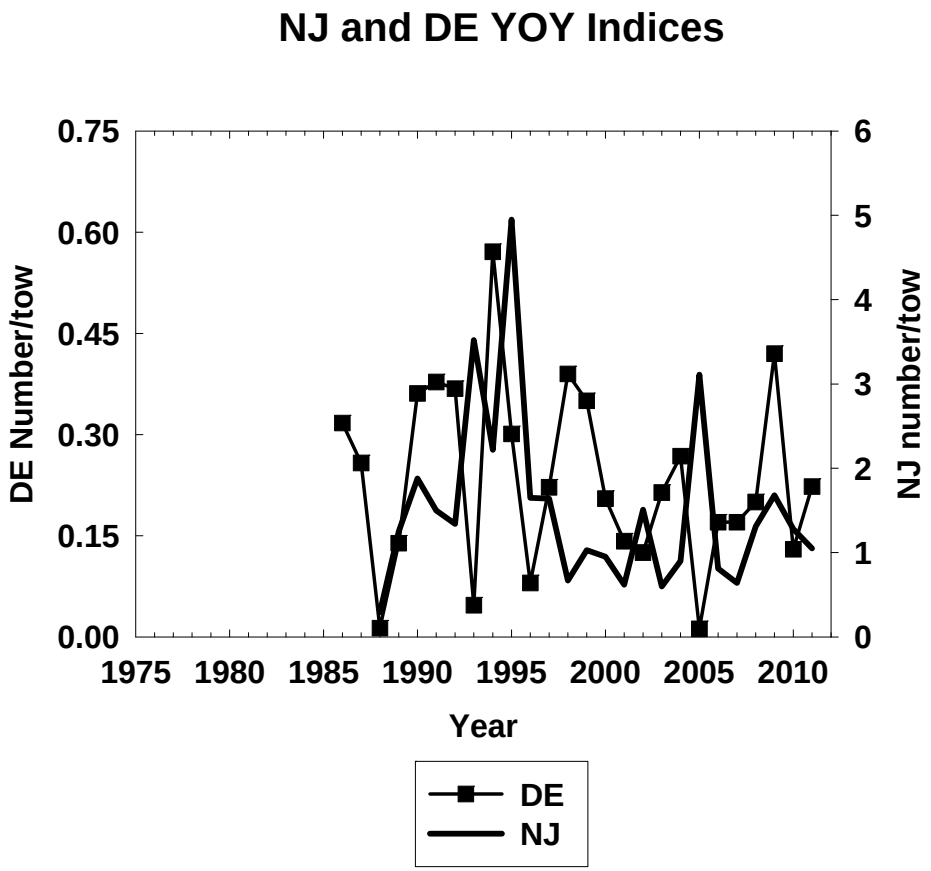

Figure 12. Trends in Delaware (DE) and New Jersey (NJ) trawl survey recruitment indices for summer flounder young of the year (YOY).

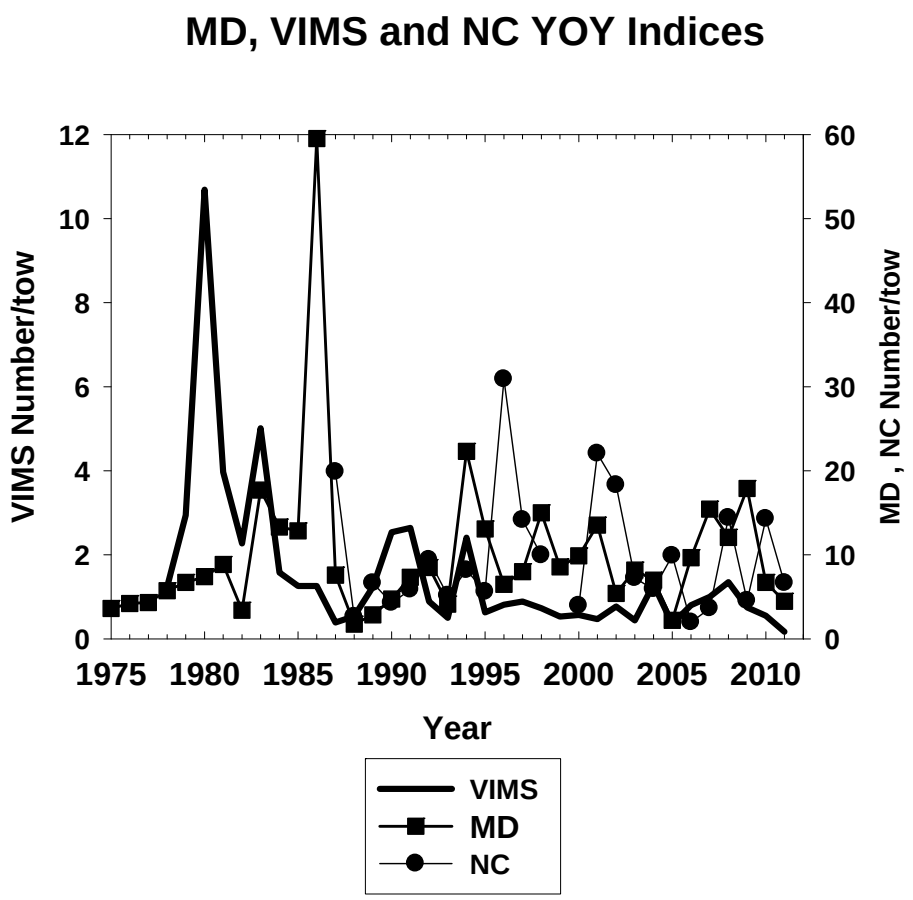

Figure 13. Trends in Maryland (MD), Virginia Institute of Marine Science (VIMS) and North Carolina (NC) trawl survey recruitment indices for summer flounder.

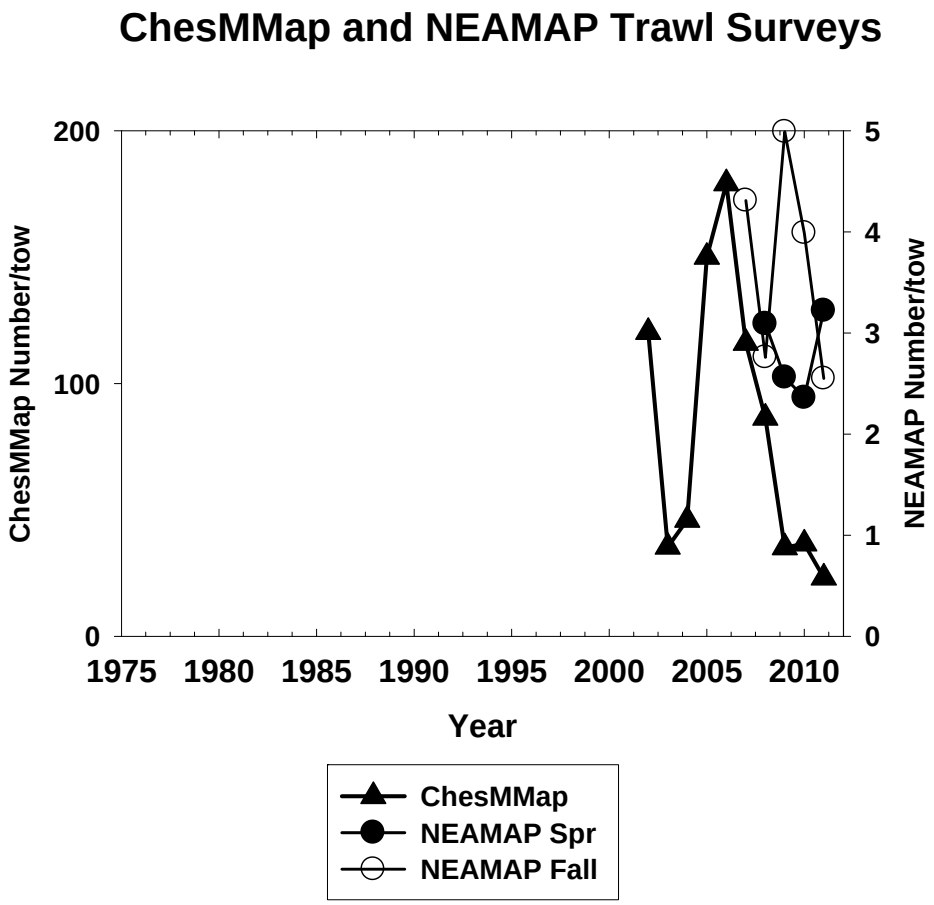

Figure 14. Trends in Northeast Area Monitoring and Assessment Program (NEAMAP) and Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) trawl survey abundance indices for summer flounder.

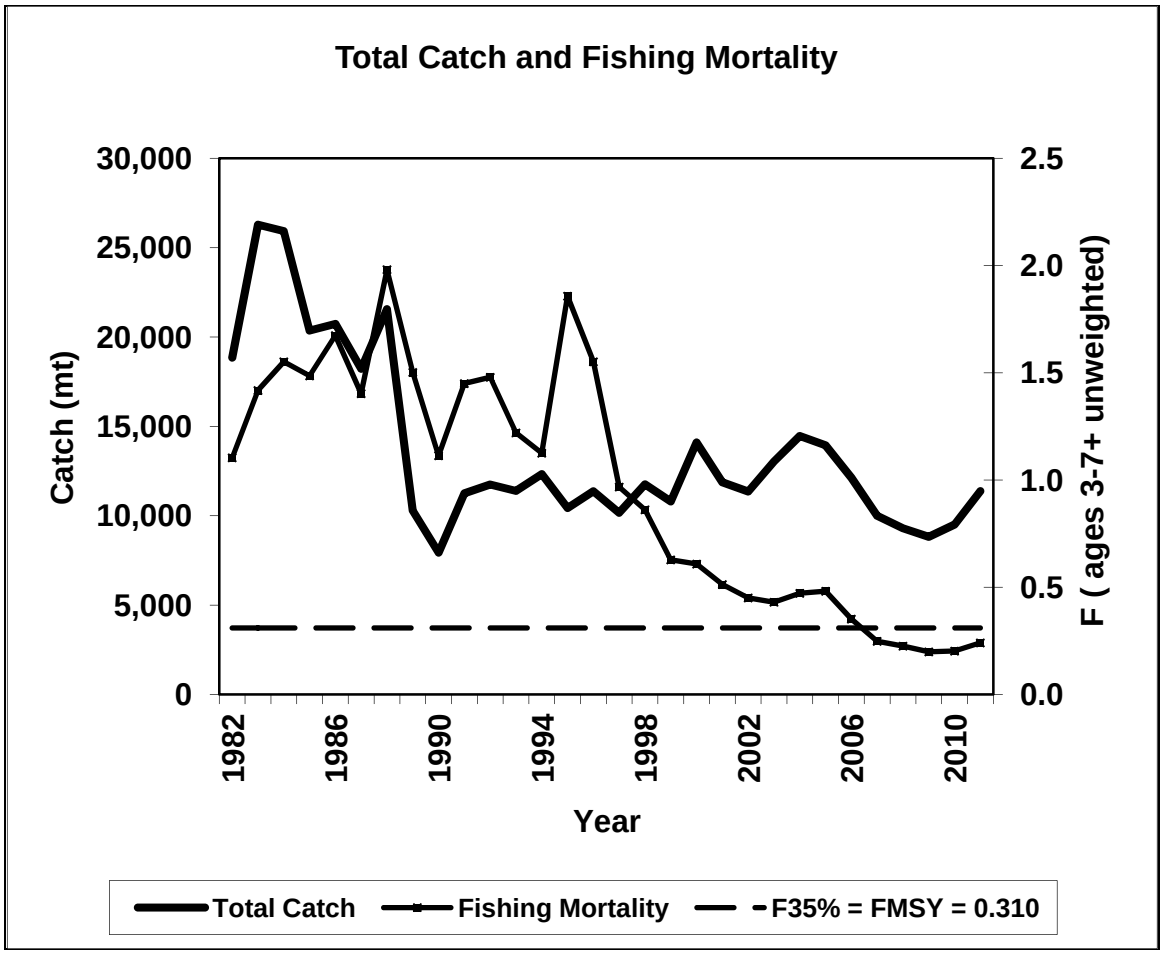

Figure 15. Total fishery catch and fishing mortality rate (F, ages 3-7+) for summer flounder. F35% is the proxy for Fishing mortality producing Maximum Sustainable Yield (FMSY).

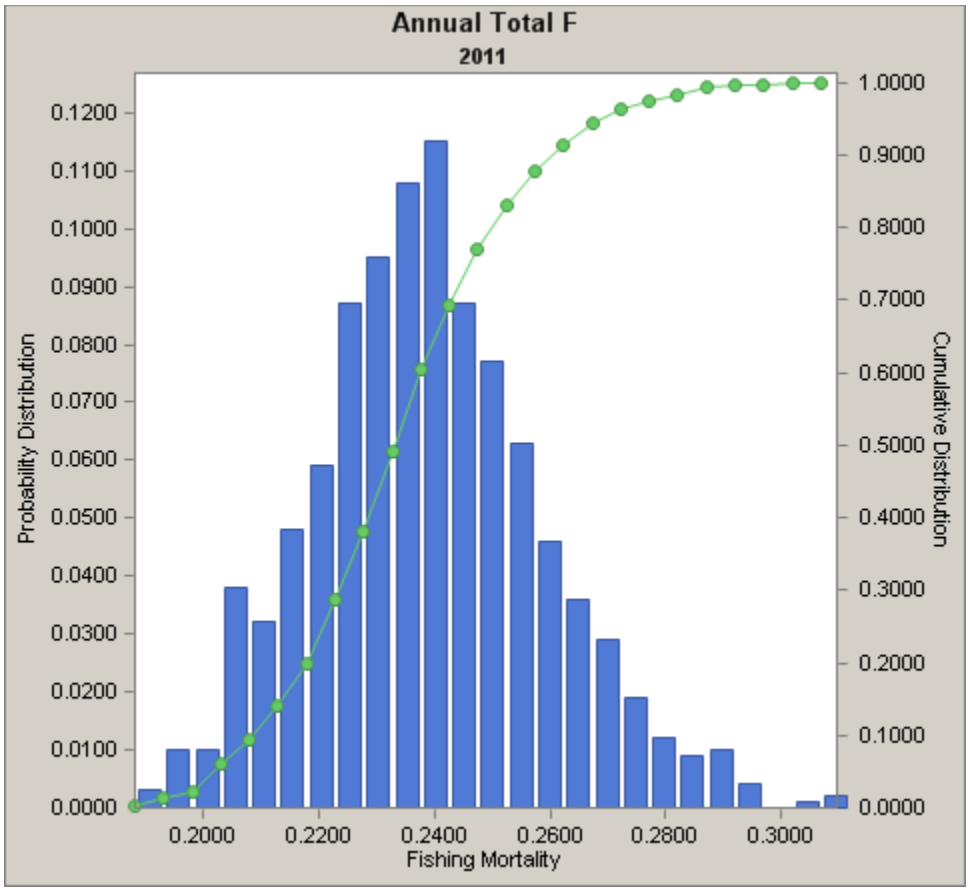

Figure 16. Markov Chain Monte Carlo (MCMC) distribution of fishing mortality rate (F, ages 3-7+).

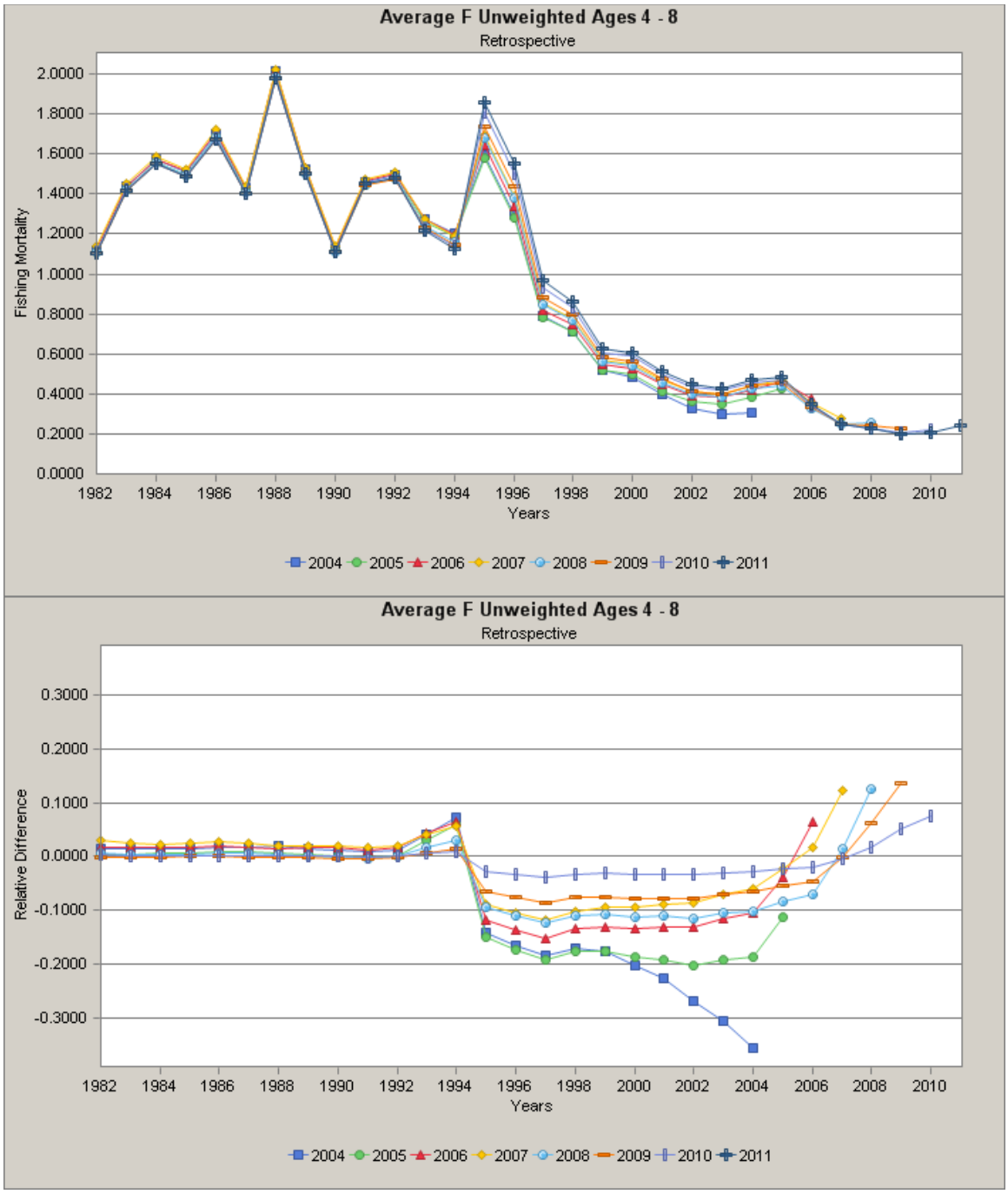

Figure 17. Retrospective analysis of fishing mortality rate (F, ages 3-7+). Note that model ages 4-8 are true ages 3-7+.

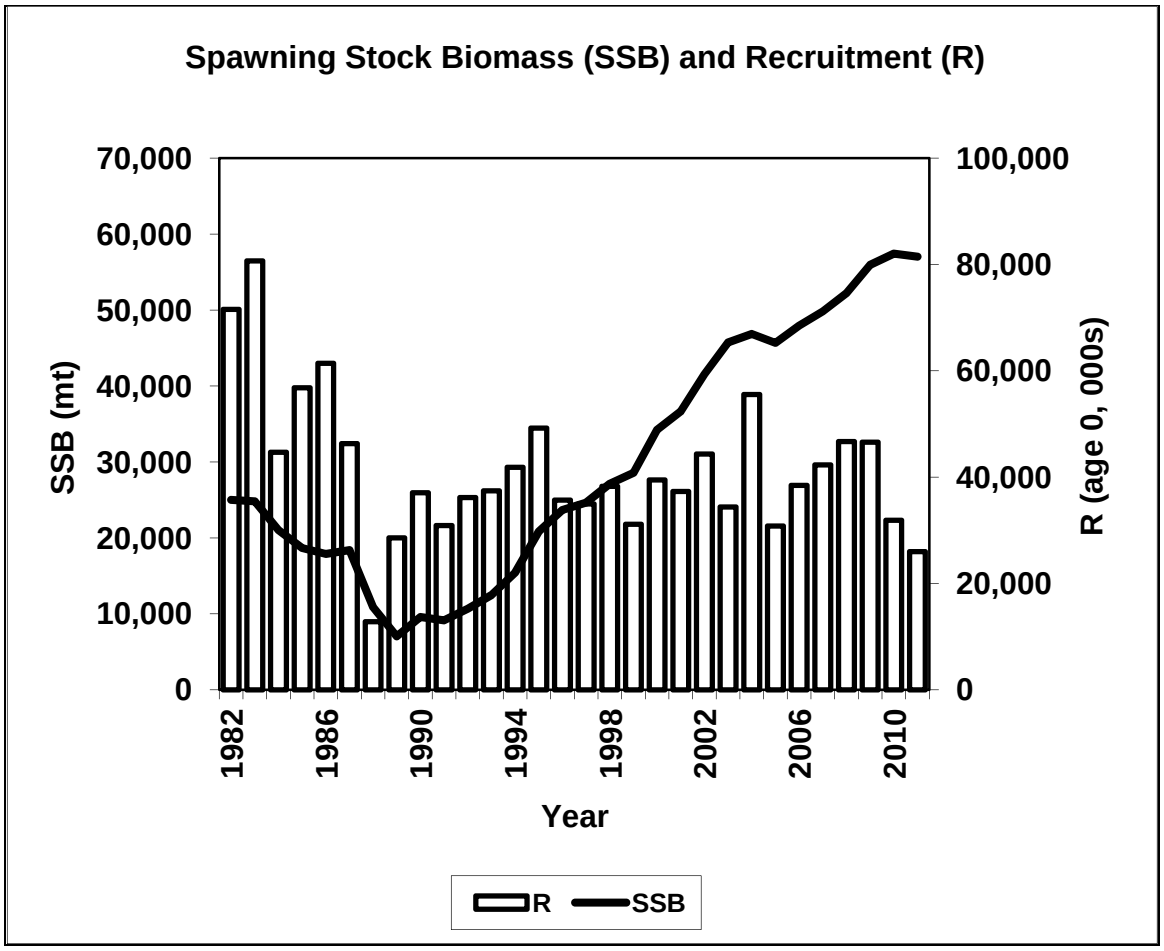

Figure 18. Spawning Stock Biomass (SSB) and Recruitment (R, age 0) by calendar year.

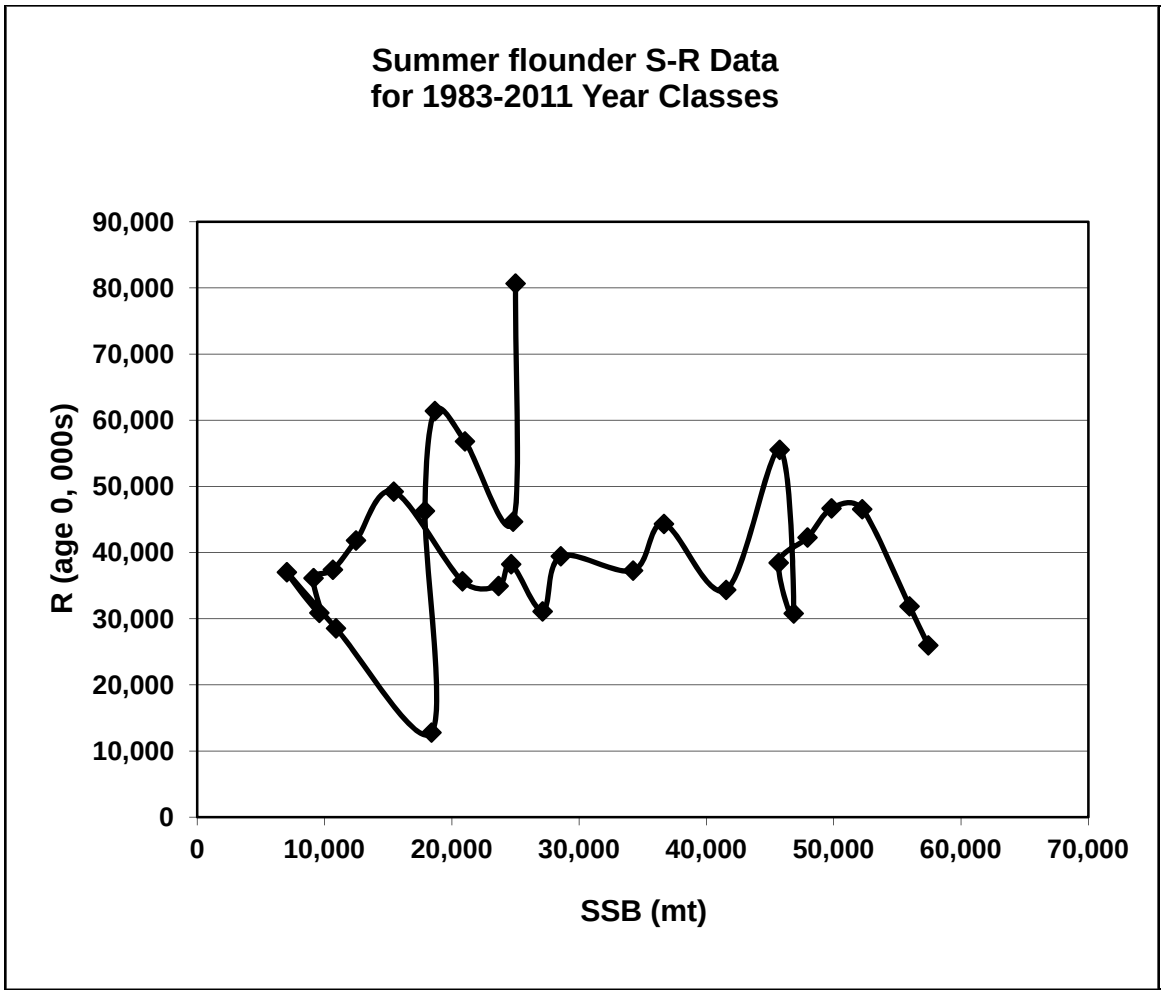

Figure 19. Spawning Stock Biomass (SSB) and Recruitment (R, age 0) scatterplot.

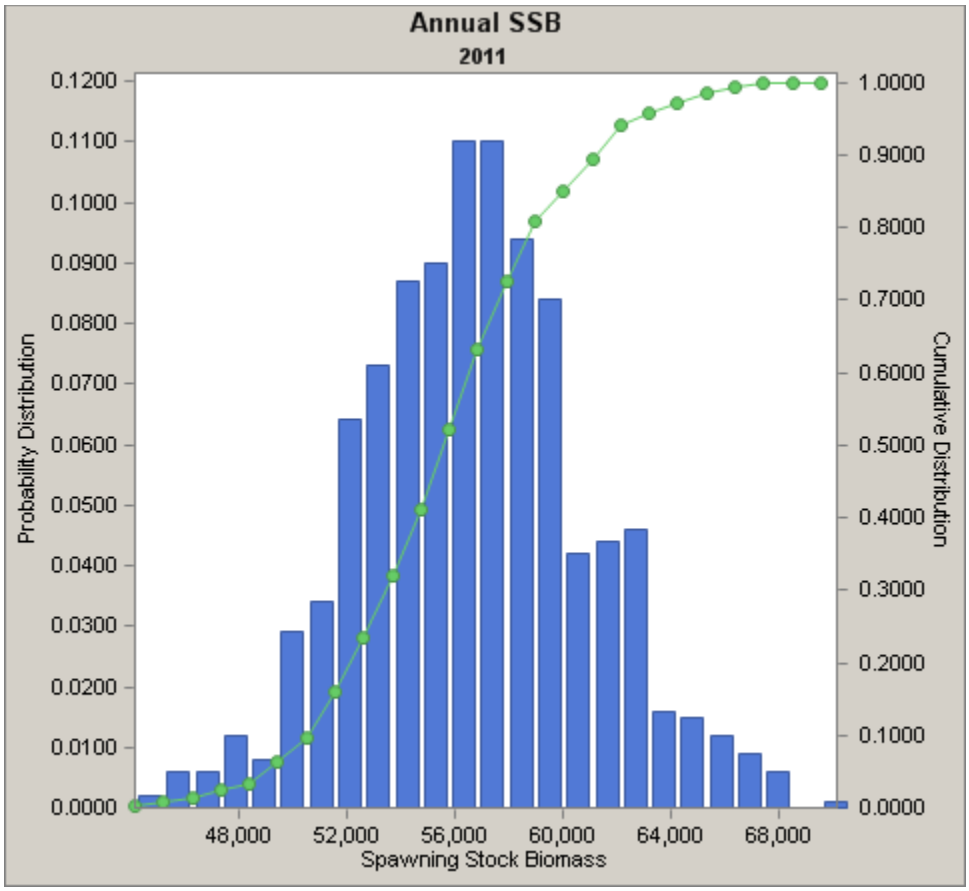

Figure 20. Markov Chain Monte Carlo (MCMC) distribution of Spawning Stock Biomass (SSB).

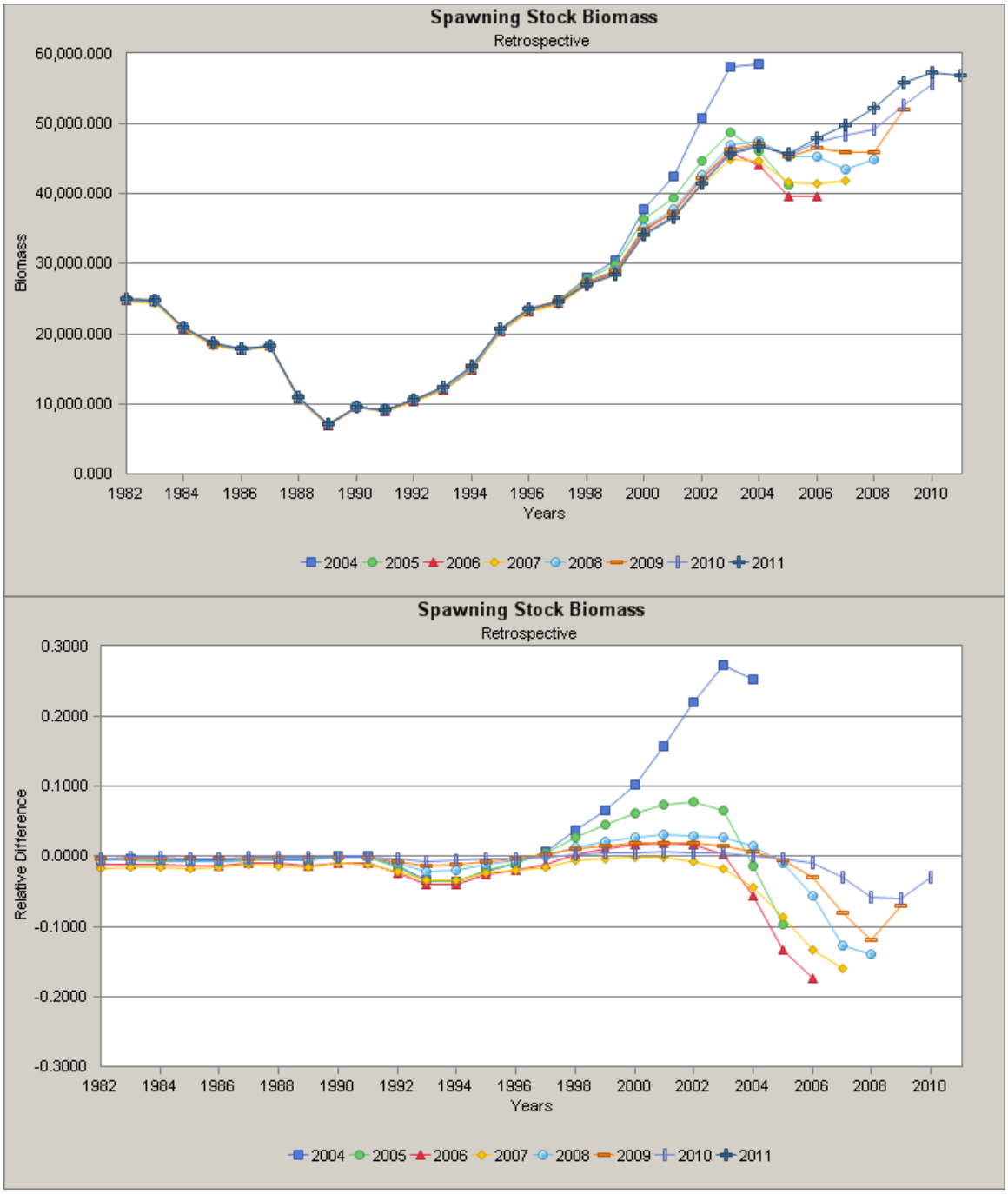

Figure 21. Retrospective analysis of Spawning Stock Biomass (SSB).

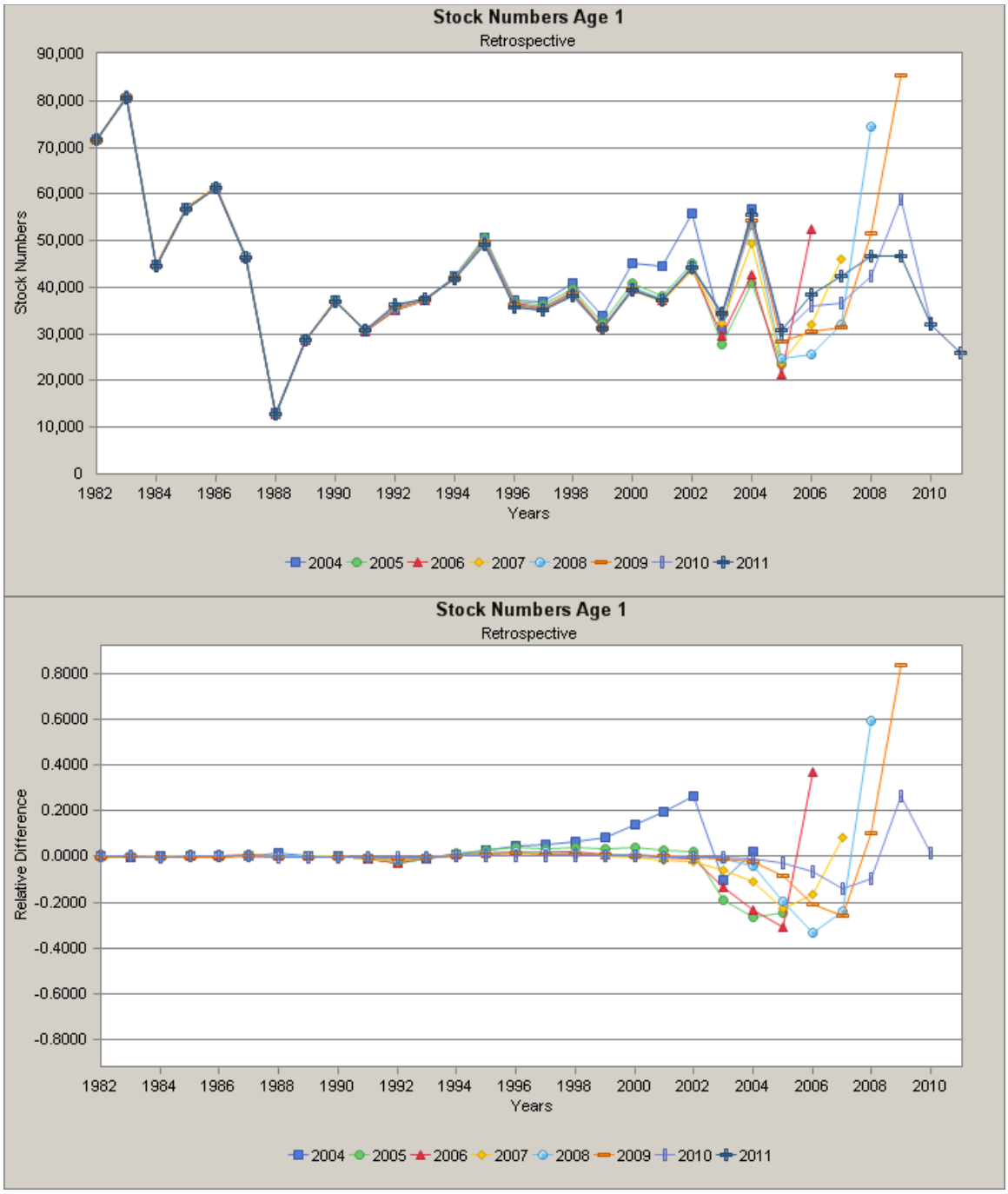

Figure 22. Retrospective analysis of recruitment (R, age 0). Note that model age 1 is true age 0.

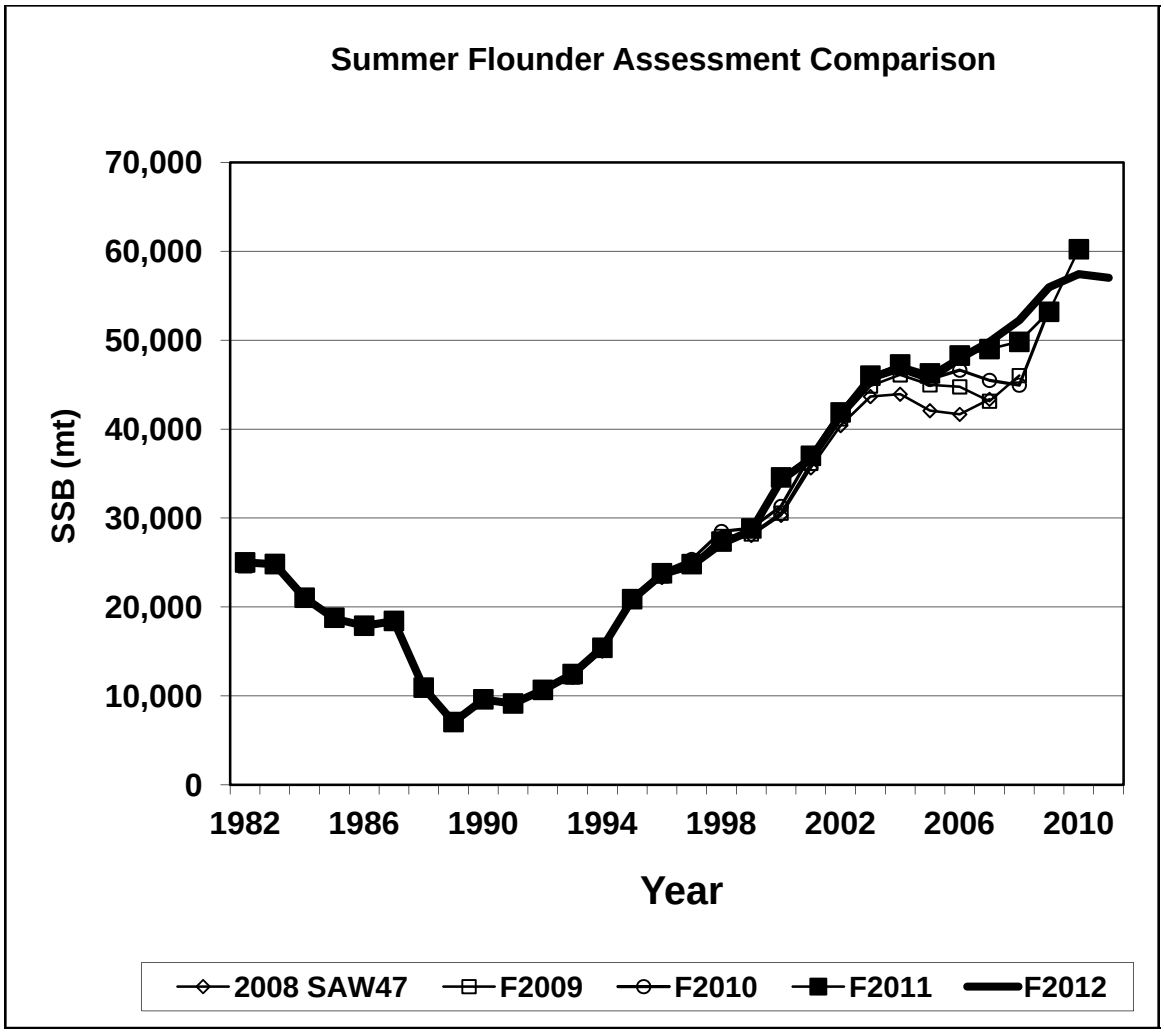

Figure 23. Comparison of the estimates for Spawning Stock Biomass (SSB) from the 2008 SAW47 and 2009-2012 updated assessments.

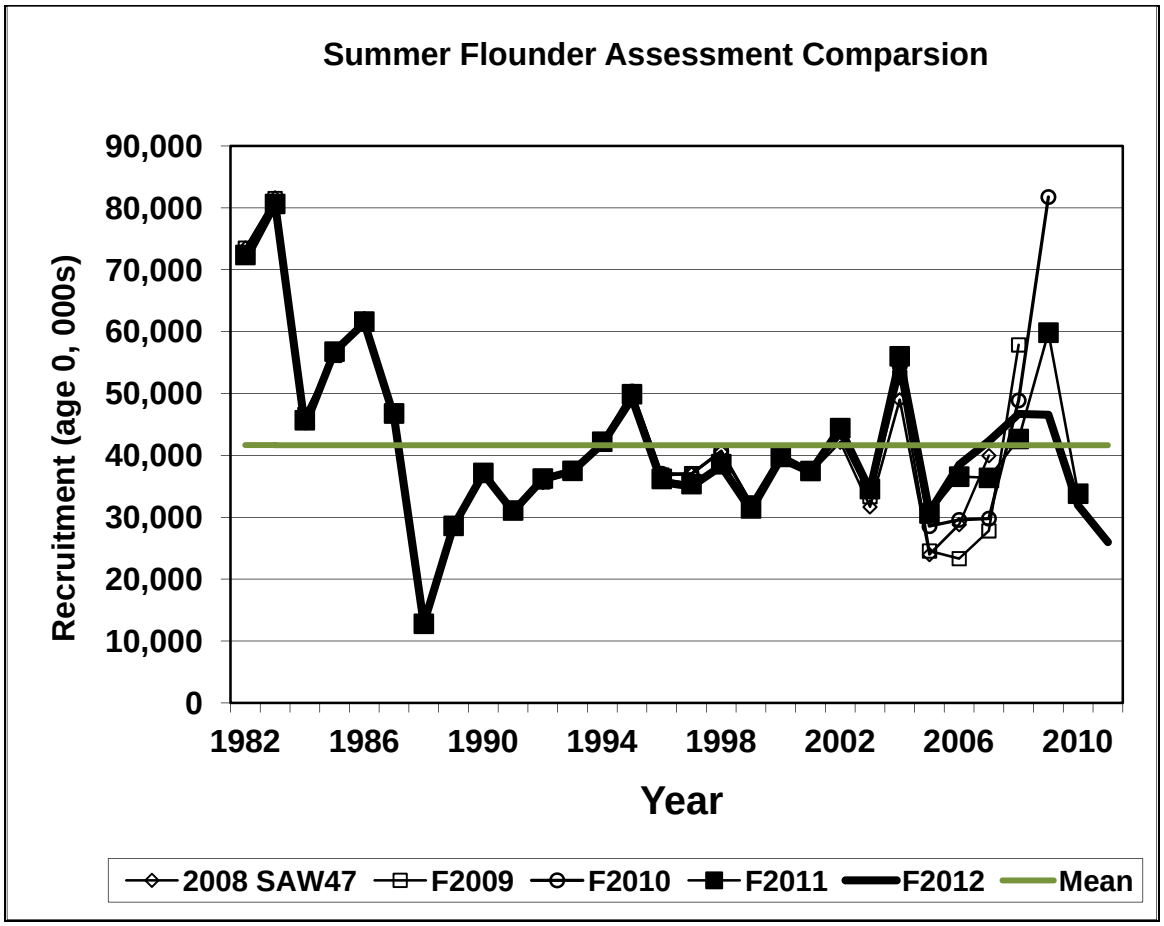

Figure 24. Comparison of the estimates for Recruitment from the 2008 SAW47 and 2009-2012 updated assessments. Mean is for the 2012 assessment update.

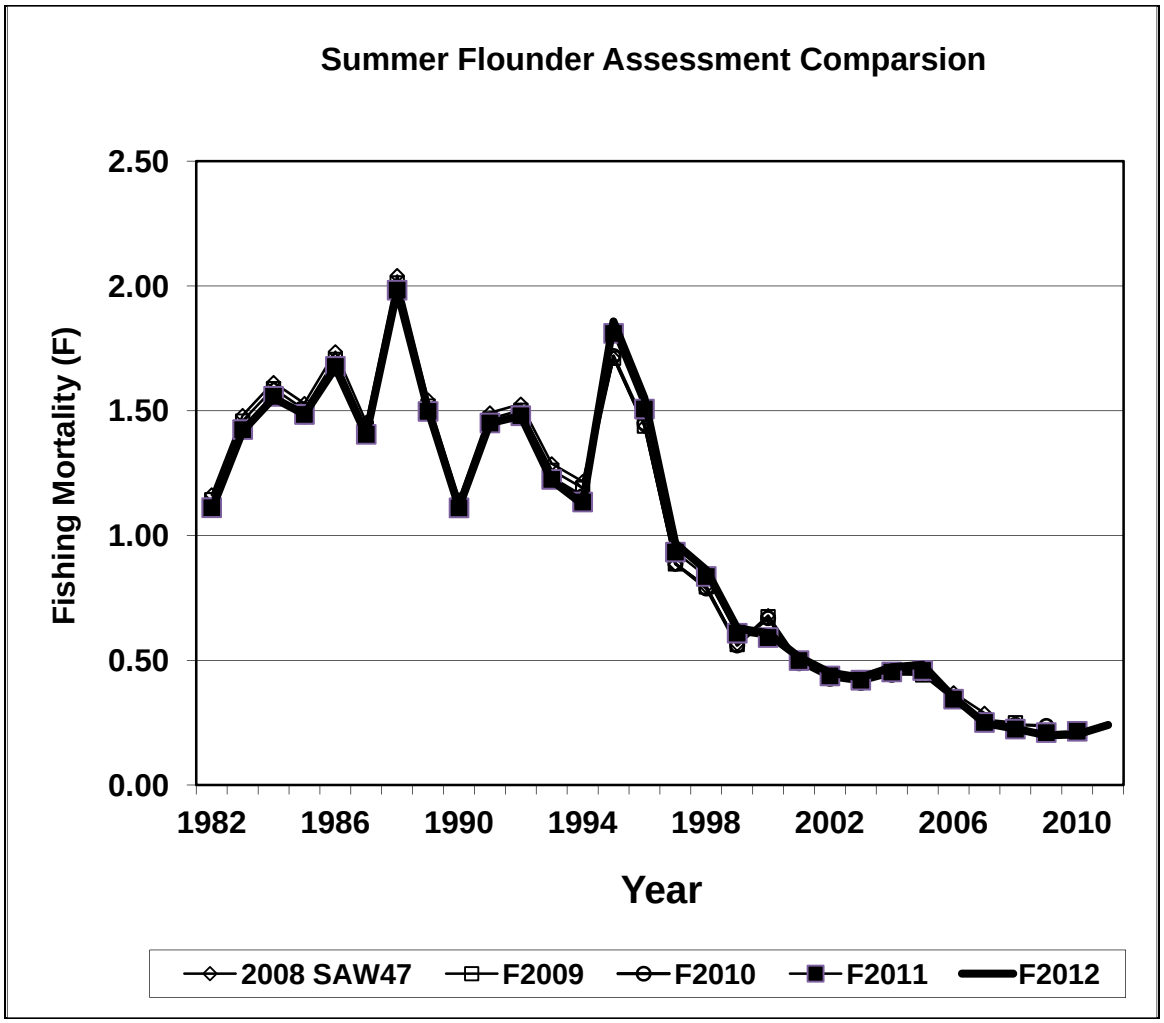

Figure 25. Comparison of the estimates for Fishing Mortality (F) from the 2008 SAW47 and 2009-2012 updated assessments.

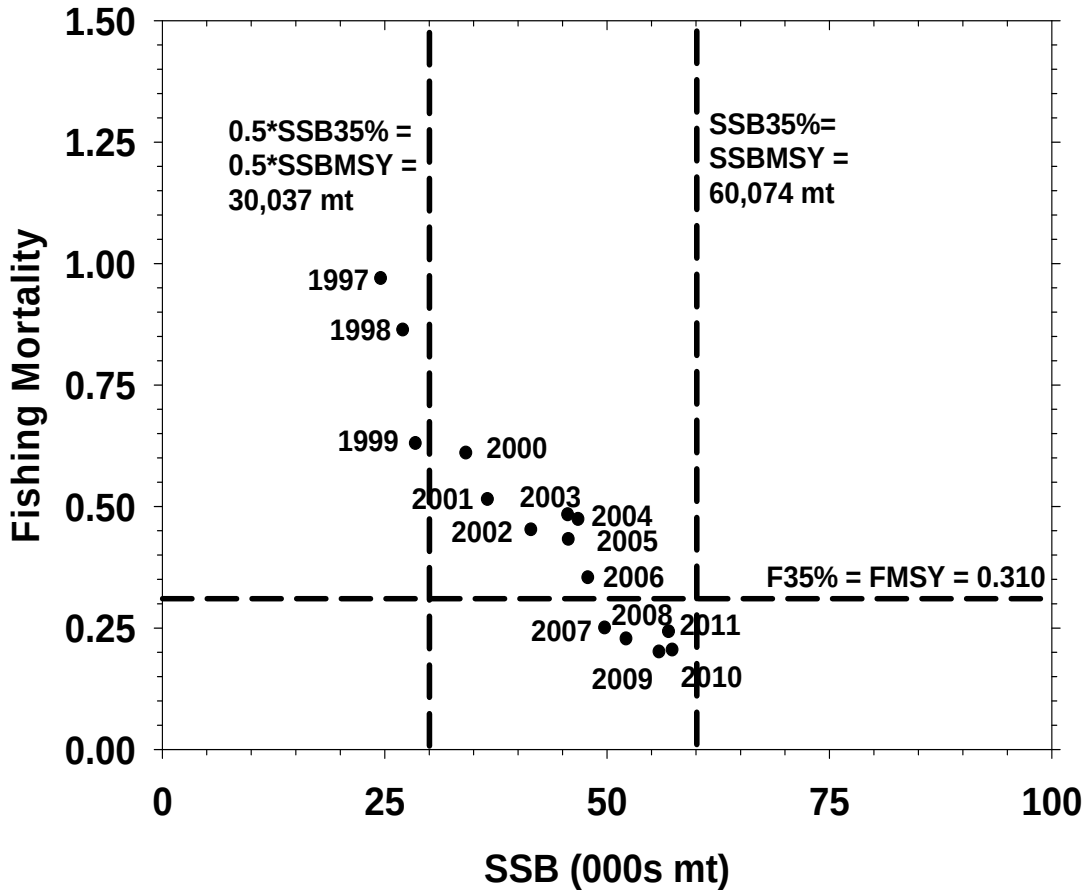

Figure 26. Trajectory in Spawning Stock Biomass (SSB) and Fishing Mortality rate (F, ages 3-7+) for summer flounder, 1997-2011. F35% is the proxy for the fishing mortality threshold Fishing mortality producing Maximum Sustainable Yield (FMSY); SSB 35% is the proxy for the biomass target Spawning Stock Biomass at Maximum Sustainable Yield (SSBMSY); 0.5*SSBMSY is the biomass threshold.

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